

# **Modulverzeichnis**

**zu der Prüfungs- und Studienordnung für  
den konsekutiven Master-Studiengang  
"Physics" (Amtliche Mitteilungen I  
Nr. 52/2016, zuletzt geändert durch  
Amtliche Mitteilungen I Nr. 41/2018 S. 823)**

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## Module

B.Che.1302.1: Chemisches Gleichgewicht: Thermodynamik und Statistik (MaW).....	12369
B.Che.2301: Chemische Reaktionskinetik.....	12370
B.Che.4104: Allgemeine und Anorganische Chemie (Lehramt und Nebenfach).....	12371
B.Che.8002: Einführung in die Physikalische Chemie für Studierende der Biologie und Geowissenschaften.....	12372
B.Che.9107: Chemisches Praktikum für Studierende der Physik und Geowissenschaften.....	12373
B.Inf.1101: Informatik I.....	12375
B.Inf.1102: Informatik II.....	12377
B.Phy.1511: Einführung in die Kern- und Teilchenphysik.....	12379
B.Phy.1512: Particle physics II - of and with quarks.....	12380
B.Phy.1521: Einführung in die Festkörperphysik.....	12381
B.Phy.1522: Solid State Physics II.....	12382
B.Phy.1531: Introduction to Materials Physics.....	12383
B.Phy.1541: Einführung in die Geophysik.....	12384
B.Phy.1551: Introduction to Astrophysics.....	12385
B.Phy.1561: Introduction to Physics of Complex Systems.....	12386
B.Phy.1571: Introduction to Biophysics.....	12387
B.Phy.1603: Vermittlung wissenschaftlicher Zusammenhänge durch neue Medien.....	12388
B.Phy.1604: Projektpraktikum.....	12389
B.Phy.1609: Grundlagen zur Einheit von Mensch und Natur.....	12390
B.Phy.5001: Die Vermittlung und Untersuchung von strömungsphysikalischen Vorgängen im Experiment Teil I.....	12391
B.Phy.5002: Die Vermittlung und Untersuchung von strömungsphysikalischen Vorgängen im Experiment Teil II.....	12392
B.Phy.5003: Sammlung und Physikalisches Museum.....	12393
B.Phy.5501: Aerodynamik.....	12394
B.Phy.5502: Aktive Galaxien.....	12395
B.Phy.5503: Astrophysical Spectroscopy.....	12396
B.Phy.5505: Data Analysis in Astrophysics.....	12397
B.Phy.5506: Einführung in die Strömungsmechanik.....	12398
B.Phy.5507: Elektromagnetische Tiefenforschung.....	12399

---

B.Phy.5508: Geophysikalische Strömungsmechanik.....	12400
B.Phy.5511: Magnetohydrodynamics.....	12401
B.Phy.5512: Low-mass stars, brown dwarfs, and planets.....	12402
B.Phy.5513: Numerical fluid dynamics.....	12403
B.Phy.5514: Physics of the Interior of the Sun and Stars.....	12404
B.Phy.5516: Physik der Galaxien.....	12405
B.Phy.5517: Physics of the Sun, Heliosphere and Space Weather: Key Knowledge.....	12406
B.Phy.5518: Physics of the Sun, Heliosphere and Space Weather: Space Weather Applications.....	12407
B.Phy.5519: Plattentektonik und Geophysikalische Exploration.....	12408
B.Phy.5521: Seminar zu einem Thema der Geophysik.....	12409
B.Phy.5522: Solar Eclipses and Physics of the Corona.....	12410
B.Phy.5523: General Relativity.....	12411
B.Phy.5531: Origin of solar systems.....	12412
B.Phy.5532: Symmetrien und Nichtlineare Differenzialgleichungen in der Physik.....	12413
B.Phy.5533: Solar and Stellar Activity.....	12415
B.Phy.5538: Stellar Atmospheres.....	12416
B.Phy.5539: Physics of Stellar Atmospheres.....	12417
B.Phy.5540: Introduction to Cosmology.....	12418
B.Phy.5543: Black Holes.....	12419
B.Phy.5544: Introduction to Turbulence.....	12420
B.Phy.5545: Angewandte Geophysik.....	12421
B.Phy.5601: Theoretical and Computational Neuroscience I.....	12422
B.Phy.5602: Theoretical and Computational Neuroscience II.....	12423
B.Phy.5603: Einführung in die Laserphysik.....	12424
B.Phy.5604: Foundations of Nonequilibrium Statistical Physics.....	12425
B.Phy.5605: Computational Neuroscience: Basics.....	12426
B.Phy.5607: Seminar: Mechanics and dynamics of the cytoskeleton.....	12427
B.Phy.5608: Micro- and Nanofluidics.....	12428
B.Phy.5611: Optical spectroscopy and microscopy.....	12429
B.Phy.5613: Soft Matter Physics.....	12430
B.Phy.5614: Proseminar Computational Neuroscience.....	12431

## Inhaltsverzeichnis

---

B.Phy.5616: Biophysics of the cell - physics on small scales.....	12432
B.Phy.5617: Seminar: Physics of soft condensed matter.....	12433
B.Phy.5618: Seminar to Biophysics of the cell - physics on small scales.....	12434
B.Phy.5619: Seminar on Micro- and Nanofluidics.....	12435
B.Phy.5620: Physics of Sports.....	12436
B.Phy.5621: Stochastic Processes.....	12437
B.Phy.5623: Theoretical Biophysics.....	12438
B.Phy.5624: Introduction to Theoretical Neuroscience.....	12439
B.Phy.5625: Röntgenphysik.....	12440
B.Phy.5628: Pattern Formation.....	12441
B.Phy.5629: Nonlinear dynamics and time series analysis.....	12443
B.Phy.5631: Self-organization in physics and biology.....	12444
B.Phy.5632: Current topics in turbulence research.....	12445
B.Phy.5639: Optical measurement techniques.....	12446
B.Phy.5642: Experimental Methods in Biophysics.....	12447
B.Phy.5643: Seminar Experimental Methods in Biophysics.....	12448
B.Phy.5645: Nanooptics and Plasmonics.....	12449
B.Phy.5646: Climate Physics.....	12450
B.Phy.5647: Physics of Coffee, Tea and other drinks.....	12451
B.Phy.5648: Theoretische und computergestützte Biophysik.....	12452
B.Phy.5649: Biomolecular Physics and Simulations.....	12454
B.Phy.5651: Advanced Computational Neuroscience.....	12455
B.Phy.5652: Advanced Computational Neuroscience II.....	12456
B.Phy.5655: Komplexe Dynamik physikalischer und biologischer Systeme.....	12457
B.Phy.5656: Experimental work at at large scale facilities for X-ray photons.....	12458
B.Phy.5657: Biophysics of gene regulation.....	12460
B.Phy.5658: Statistical Biophysics.....	12461
B.Phy.5659: Seminar on current topics in theoretical biophysics.....	12462
B.Phy.5660: Theoretical Biofluid Mechanics.....	12463
B.Phy.5661: Biomedical Techniques in Complex Systems.....	12464
B.Phy.5662: Active Soft Matter.....	12465

---

B.Phy.5663: Stochastic Dynamics.....	12466
B.Phy.5664: Excursion to DESY and the European XFEL, Hamburg.....	12467
B.Phy.5665: Processing of Signals and Measured Data.....	12468
B.Phy.5701: Weiche Materie: Flüssigkristalle.....	12469
B.Phy.5702: Dünne Schichten.....	12470
B.Phy.5709: Seminar on Nanoscience.....	12471
B.Phy.5714: Introduction to Solid State Theory.....	12472
B.Phy.5716: Nano-Optics meets Strong-Field Physics.....	12473
B.Phy.5717: Mechanisms and Materials for Renewable Energy.....	12474
B.Phy.5718: Mechanisms and Materials for Renewable Energy: Photovoltaics.....	12475
B.Phy.5719: Mechanisms and Materials for Renewable Energy: Solar heat, Thermoelectric, solar fuel..	12476
B.Phy.5720: Introduction to Ultrashort Pulses and Nonlinear Optics.....	12477
B.Phy.5721: Information and Physics.....	12478
B.Phy.5722: Seminar on Topics in Nonlinear Optics.....	12479
B.Phy.5723: Hands-on course on Density-Functional calculations 1.....	12480
B.Phy.5724: Hands-on course on Density-Functional calculations 1+2.....	12481
B.Phy.5804: Quantum mechanics II.....	12482
B.Phy.5805: Quantum field theory I.....	12483
B.Phy.5806: Spezielle Relativitätstheorie.....	12484
B.Phy.5807: Physics of particle accelerators.....	12485
B.Phy.5808: Interactions between radiation and matter - detector physics.....	12486
B.Phy.5809: Hadron-Collider-Physics.....	12487
B.Phy.5810: Physics of the Higgs boson.....	12488
B.Phy.5811: Statistical methods in data analysis.....	12489
B.Phy.5812: Physics of the top-quark.....	12490
B.Phy.5815: Seminar zu einführenden Themen der Teilchenphysik.....	12491
B.Phy.5816: Phenomenology of Physics Beyond the Standard Model.....	12492
B.Phy.5901: Advanced Algorithms for Computational Physics.....	12493
B.Phy.5902: Physik für BundeskanzlerInnen, ManagerInnen und BürgerInnen.....	12494
B.Phy.606: Electronic Lab Course for Natural Scientists.....	12495
B.Phy.607: Akademisches Schreiben für Physiker/innen.....	12496

## Inhaltsverzeichnis

---

B.Phys.608: Scientific Literacy - Integration von Naturwissenschaften in die Gesellschaft und Politik.....	12497
B.SK-Phy.9001: Papers, Proposals, Presentations: Skills of Scientific Communication.....	12498
M.Che.1314: Biophysikalische Chemie.....	12499
M.Phys-AM.001: Active Galactic Nuclei.....	12500
M.Phys-AM.002: Stellar structure and evolution.....	12501
M.Phys-AM.003: Stellar Atmosphere.....	12502
M.Phys-AM.012: Astrophysical Properties: From planets to cosmology.....	12503
M.Phys.1401: Advanced Lab Course I.....	12504
M.Phys.1402: Advanced Lab Course II.....	12505
M.Phys.1403: Internship.....	12506
M.Phys.1601: Development and Realization of Scientific Projects in Astro-/Geophysics.....	12507
M.Phys.1602: Development and Realization of Scientific Projects in Biophysics/Complex Systems.....	12508
M.Phys.1603: Development and Realization of Scientific Projects in Solid State/Materials Physics.....	12509
M.Phys.1604: Development and Realization of Scientific Projects in Nuclear/Particle Physics.....	12510
M.Phys.1605: Networking in Astro-/Geophysics.....	12511
M.Phys.1606: Networking in Biophysics/Physics of Complex Systems.....	12512
M.Phys.1607: Networking in Solid State/Materials Physics.....	12513
M.Phys.1608: Networking in Nuclear/Particle Physics.....	12514
M.Phys.405: Research Lab Course in Astro- and Geophysics.....	12515
M.Phys.406: Research Lab Course in Biophysics and Physics of Complex Systems.....	12516
M.Phys.407: Research Lab Course in Solid State/Materials Physics.....	12517
M.Phys.408: Research Lab Course in Nuclear and Particle Physics.....	12518
M.Phys.409: Research Seminar Astro-/Geophysics.....	12519
M.Phys.410: Research Seminar Biophysics/Physics of Complex Systems.....	12520
M.Phys.411: Research Seminar Solid State/Materials Physics.....	12521
M.Phys.412: Research Seminar Particle Physics.....	12522
M.Phys.413: General Seminar.....	12523
M.Phys.5002: Contemporary Physics.....	12524
M.Phys.5501: Kompressible Strömungen.....	12525
M.Phys.5502: Numerical experiments in stellar astrophysics.....	12526
M.Phys.5505: Erforschung des Sonnensystems durch Raummissionen.....	12527

---

M.Phy.551: Advanced Topics in Astro-/Geophysics I.....	12529
M.Phy.552: Advanced Topics in Astro-/Geophysics II.....	12530
M.Phy.556: Seminar Advanced Topics in Astro-/Geophysics.....	12531
M.Phy.5601: Seminar Computational Neuroscience/Neuroinformatik.....	12532
M.Phy.5604: Biomedicine imaging physics and medical physics.....	12533
M.Phy.5608: Liquid State Physics.....	12534
M.Phy.5609: Turbulence Meets Active Matter.....	12536
M.Phy.561: Advanced Topics in Biophysics/Physics of complex systems I.....	12538
M.Phy.5613: Vorlesung: Principles and Applications of Synchrotron and Free Electron Laser Radiation	12539
M.Phy.5614: Praktikum: Principles and Applications of Synchrotron and Free Electron Laser Radiation.	12541
M.Phy.562: Advanced Topics in Biophysics/Physics of complex systems II.....	12543
M.Phy.566: Seminar Advanced Topics in Biophysics/Complex Systems.....	12544
M.Phy.5701: Advanced Solid State Theory.....	12545
M.Phy.5703: Materialforschung mit Elektronen.....	12546
M.Phy.5705: Materials Physics I: Microstructure-Property-Relations.....	12547
M.Phy.5706: Materials Physics II: Kinetics and Phase Transformations.....	12548
M.Phy.5707: Materials research with electrons.....	12549
M.Phy.5708: Physics of Semiconductor Devices.....	12550
M.Phy.5709: Physics of Semiconductors.....	12551
M.Phy.571: Advanced Topics in Solid State/Materials Physics I.....	12552
M.Phy.5710: Physics of Semiconductors and Semiconductor Devices.....	12553
M.Phy.5711: Surface Physics.....	12554
M.Phy.5712: Topology in Condensed Matter Physics.....	12555
M.Phy.572: Advanced Topics in Solid State/Materials Physics II.....	12556
M.Phy.576: Seminar Advanced Topics in Solid State/Materials Physics.....	12557
M.Phy.5801: Detectors for particle physics and imaging.....	12558
M.Phy.5804: Simulation methods for theoretical particle physics.....	12559
M.Phy.5807: Particle Physics III - of and with leptons.....	12560
M.Phy.581: Advanced Topics in Nuclear and Particle Physics I.....	12561
M.Phy.5810: Physics and Applications of Ion solid interaction.....	12562
M.Phy.5811: Nuclear Solid State Physics.....	12563



## Inhaltsverzeichnis

---

M.Phy.5812: Nuclear Reactor Physics.....	12564
M.Phy.582: Advanced Topics in Particle Physics II.....	12565
M.Phy.586: Seminar Advanced Topics in Particle Physics.....	12566
M.Phy.603: Writing scientific articles.....	12567

# Übersicht nach Modulgruppen

## I. Master-Studiengang "Physics"

Es müssen nach Maßgabe der folgenden Bestimmungen wenigstens 120 C erworben werden.

### 1. Praktika

Es müssen folgende Praktika im Umfang von insgesamt 12 C nach Maßgabe der folgenden Bestimmungen erfolgreich absolviert werden.

#### a. Praktikum Teil I

Es muss folgendes Modul im Umfang von 6 C erfolgreich absolviert werden:

M.Phy.1401: Advanced Lab Course I (6 C, 6 SWS)..... 12504

#### b. Praktikum Teil II

Es muss eines der folgenden Wahlpflichtmodule im Umfang von 6 C erfolgreich absolviert werden; das Modul B.Phy.606 darf nur gewählt werden, sofern es nicht bereits im Bachelorstudium eingebracht wurde:

M.Phy.1402: Advanced Lab Course II (6 C, 6 SWS)..... 12505

M.Phy.1403: Internship (6 C, 6 SWS).....12506

B.Phy.606: Electronic Lab Course for Natural Scientists (6 C, 6 SWS)..... 12495

## 2. Forschungsschwerpunkt

Der Master-Studiengang "Physics" muss mit einem der vier Studienschwerpunkte "Astro- und Geophysik", "Biophysik und Physik komplexer Systeme", "Festkörper- und Materialphysik" oder "Kern- und Teilchenphysik" im Umfang von jeweils wenigstens 56 C nach Maßgabe der folgenden Bestimmungen studiert werden.

### a. Forschungsschwerpunkt "Astro- und Geophysik"

Es müssen Module im Umfang von insgesamt wenigstens 56 C nach Maßgabe der nachfolgenden Bestimmungen erfolgreich absolviert werden.

#### aa. Erster Studienschritt (1. und 2. Semester)

Es müssen Module im Umfang von insgesamt wenigstens 26 C nach Maßgabe der folgenden Bestimmungen erfolgreich absolviert werden.

#### i. Forschungsseminar

Es muss folgendes Modul im Umfang von 4 C erfolgreich absolviert werden:

M.Phy.409: Research Seminar Astro-/Geophysics (4 C, 2 SWS)..... 12519

## ii. Wahlpflichtbereich A

Es muss folgendes Modul im Umfang von 8 C erfolgreich absolviert werden, soweit dieses Modul nicht bereits im Rahmen des Bachelorstudiums erfolgreich absolviert wurde:

B.Phy.1551: Introduction to Astrophysics (8 C, 6 SWS)..... 12385

## iii. Wahlpflichtbereich B

Ergänzend muss die Differenz zu den 26 C durch erfolgreiche Absolvierung wenigstens eines der folgenden Module erbracht werden; bereits im Bachelorstudium absolvierte Module können nicht berücksichtigt werden:

B.Phy.1511: Einführung in die Kern- und Teilchenphysik (8 C, 6 SWS)..... 12379

B.Phy.1521: Einführung in die Festkörperphysik (8 C, 6 SWS)..... 12381

B.Phy.1531: Introduction to Materials Physics (4 C, 4 SWS)..... 12383

B.Phy.1541: Einführung in die Geophysik (4 C, 3 SWS)..... 12384

B.Phy.1561: Introduction to Physics of Complex Systems (8 C, 6 SWS)..... 12386

B.Phy.1571: Introduction to Biophysics (8 C, 6 SWS)..... 12387

B.Phy.5001: Die Vermittlung und Untersuchung von strömungsphysikalischen Vorgängen im Experiment Teil I (6 C, 4 SWS)..... 12391

B.Phy.5002: Die Vermittlung und Untersuchung von strömungsphysikalischen Vorgängen im Experiment Teil II (6 C, 4 SWS)..... 12392

B.Phy.5003: Sammlung und Physikalisches Museum (4 C, 2 SWS)..... 12393

B.Phy.5501: Aerodynamik (6 C, 4 SWS)..... 12394

B.Phy.5502: Aktive Galaxien (3 C, 2 SWS)..... 12395

B.Phy.5503: Astrophysical Spectroscopy (3 C, 2 SWS)..... 12396

B.Phy.5505: Data Analysis in Astrophysics (3 C, 2 SWS)..... 12397

B.Phy.5506: Einführung in die Strömungsmechanik (6 C, 4 SWS)..... 12398

B.Phy.5507: Elektromagnetische Tiefenforschung (3 C, 2 SWS)..... 12399

B.Phy.5508: Geophysikalische Strömungsmechanik (3 C, 2 SWS)..... 12400

B.Phy.5511: Magnetohydrodynamics (3 C, 2 SWS)..... 12401

B.Phy.5512: Low-mass stars, brown dwarfs, and planets (3 C, 2 SWS)..... 12402

B.Phy.5513: Numerical fluid dynamics (6 C, 4 SWS)..... 12403

B.Phy.5514: Physics of the Interior of the Sun and Stars (3 C, 2 SWS)..... 12404

B.Phy.5516: Physik der Galaxien (3 C, 2 SWS)..... 12405

B.Phy.5517: Physics of the Sun, Heliosphere and Space Weather: Key Knowledge (3 C, 2 SWS)..... 12406

---

B.Phy.5518: Physics of the Sun, Heliosphere and Space Weather: Space Weather Applications (3 C, 2 SWS).....	12407
B.Phy.5519: Plattentektonik und Geophysikalische Exploration (3 C, 2 SWS).....	12408
B.Phy.5521: Seminar zu einem Thema der Geophysik (4 C, 2 SWS).....	12409
B.Phy.5522: Solar Eclipses and Physics of the Corona (3 C, 2 SWS).....	12410
B.Phy.5523: General Relativity (6 C, 6 SWS).....	12411
B.Phy.5531: Origin of solar systems (3 C, 2 SWS).....	12412
B.Phy.5532: Symmetrien und Nichtlineare Differenzialgleichungen in der Physik (6 C, 6 SWS).....	12413
B.Phy.5533: Solar and Stellar Activity (6 C, 4 SWS).....	12415
B.Phy.5538: Stellar Atmospheres (6 C, 4 SWS).....	12416
B.Phy.5539: Physics of Stellar Atmospheres (3 C, 2 SWS).....	12417
B.Phy.5540: Introduction to Cosmology (3 C, 2 SWS).....	12418
B.Phy.5543: Black Holes (3 C, 2 SWS).....	12419
B.Phy.5544: Introduction to Turbulence (3 C, 2 SWS).....	12420
B.Phy.5545: Angewandte Geophysik (3 C, 3 SWS).....	12421
B.Phy.5632: Current topics in turbulence research (4 C, 2 SWS).....	12445
B.Phy.5646: Climate Physics (6 C, 4 SWS).....	12450
B.Phy.5665: Processing of Signals and Measured Data (3 C, 2 SWS).....	12468
B.Phy.5804: Quantum mechanics II (6 C, 6 SWS).....	12482
B.Phy.5805: Quantum field theory I (6 C, 6 SWS).....	12483
B.Phy.5811: Statistical methods in data analysis (3 C, 3 SWS).....	12489
B.Phy.5901: Advanced Algorithms for Computational Physics (6 C, 4 SWS).....	12493
M.Phy-AM.001: Active Galactic Nuclei (6 C, 2 SWS).....	12500
M.Phy-AM.002: Stellar structure and evolution (6 C, 2 SWS).....	12501
M.Phy-AM.003: Stellar Atmosphere (6 C, 4 SWS).....	12502
M.Phy.5002: Contemporary Physics (4 C, 2 SWS).....	12524
M.Phy.5501: Kompressible Strömungen (3 C, 2 SWS).....	12525
M.Phy.5502: Numerical experiments in stellar astrophysics (3 C, 2 SWS).....	12526
M.Phy.5505: Erforschung des Sonnensystems durch Raummissionen (3 C, 2 SWS)....	12527
M.Phy.551: Advanced Topics in Astro-/Geophysics I (6 C, 6 SWS).....	12529
M.Phy.552: Advanced Topics in Astro-/Geophysics II (6 C, 4 SWS).....	12530

M.Phys.556: Seminar Advanced Topics in Astro-/Geophysics (4 C, 2 SWS).....	12531
M.Phys.5609: Turbulence Meets Active Matter (4 C, 4 SWS).....	12536

**bb. Zweiter Studienabschnitt (3. Semester)**

Es müssen folgende drei Module im Umfang von insgesamt 30 C erfolgreich absolviert werden:

M.Phys.1601: Development and Realization of Scientific Projects in Astro-/Geophysics (9 C).....	12507
M.Phys.1605: Networking in Astro-/Geophysics (3 C).....	12511
M.Phys.405: Research Lab Course in Astro- and Geophysics (18 C).....	12515

**b. Forschungsschwerpunkt "Biophysik und Physik komplexer Systeme"**

Es müssen Module im Umfang von insgesamt wenigstens 56 C nach Maßgabe der nachfolgenden Bestimmungen erfolgreich absolviert werden.

**aa. Erster Studienabschnitt (1. und 2. Semester)**

Es müssen Module im Umfang von insgesamt wenigstens 26 C nach Maßgabe der folgenden Bestimmungen erfolgreich absolviert werden.

**i. Forschungsseminar**

Es muss folgendes Modul im Umfang von 4 C erfolgreich absolviert werden:

M.Phys.410: Research Seminar Biophysics/Physics of Complex Systems (4 C, 2 SWS).	12520
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**ii. Wahlpflichtbereich A**

Es muss mindestens eines der folgenden Module im Umfang von 8 C erfolgreich absolviert werden, soweit diese oder entsprechende Module nicht bereits im Rahmen des Bachelorstudiums erfolgreich absolviert wurden:

B.Phys.1561: Introduction to Physics of Complex Systems (8 C, 6 SWS).....	12386
B.Phys.1571: Introduction to Biophysics (8 C, 6 SWS).....	12387

**iii. Wahlpflichtbereich B**

Ergänzend muss die Differenz zu den 26 C durch erfolgreiche Absolvierung wenigstens eines der folgenden Module erbracht werden; bereits im Bachelorstudium absolvierte Module können nicht berücksichtigt werden:

B.Phys.1511: Einführung in die Kern- und Teilchenphysik (8 C, 6 SWS).....	12379
B.Phys.1521: Einführung in die Festkörperphysik (8 C, 6 SWS).....	12381
B.Phys.1531: Introduction to Materials Physics (4 C, 4 SWS).....	12383
B.Phys.1541: Einführung in die Geophysik (4 C, 3 SWS).....	12384
B.Phys.1551: Introduction to Astrophysics (8 C, 6 SWS).....	12385

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B.Phy.5001: Die Vermittlung und Untersuchung von strömungsphysikalischen Vorgängen im Experiment Teil I (6 C, 4 SWS).....	12391
B.Phy.5002: Die Vermittlung und Untersuchung von strömungsphysikalischen Vorgängen im Experiment Teil II (6 C, 4 SWS).....	12392
B.Phy.5003: Sammlung und Physikalisches Museum (4 C, 2 SWS).....	12393
B.Phy.5501: Aerodynamik (6 C, 4 SWS).....	12394
B.Phy.5506: Einführung in die Strömungsmechanik (6 C, 4 SWS).....	12398
B.Phy.5513: Numerical fluid dynamics (6 C, 4 SWS).....	12403
B.Phy.5523: General Relativity (6 C, 6 SWS).....	12411
B.Phy.5544: Introduction to Turbulence (3 C, 2 SWS).....	12420
B.Phy.5601: Theoretical and Computational Neuroscience I (3 C, 2 SWS).....	12422
B.Phy.5602: Theoretical and Computational Neuroscience II (3 C, 2 SWS).....	12423
B.Phy.5603: Einführung in die Laserphysik (3 C, 2 SWS).....	12424
B.Phy.5604: Foundations of Nonequilibrium Statistical Physics (3 C, 2 SWS).....	12425
B.Phy.5605: Computational Neuroscience: Basics (3 C, 2 SWS).....	12426
B.Phy.5607: Seminar: Mechanics and dynamics of the cytoskeleton (4 C, 2 SWS).....	12427
B.Phy.5608: Micro- and Nanofluidics (3 C, 2 SWS).....	12428
B.Phy.5611: Optical spectroscopy and microscopy (3 C, 2 SWS).....	12429
B.Phy.5613: Soft Matter Physics (3 C, 2 SWS).....	12430
B.Phy.5614: Proseminar Computational Neuroscience (4 C, 2 SWS).....	12431
B.Phy.5617: Seminar: Physics of soft condensed matter (4 C, 2 SWS).....	12433
B.Phy.5618: Seminar to Biophysics of the cell - physics on small scales (4 C, 2 SWS)..	12434
B.Phy.5619: Seminar on Micro- and Nanofluidics (4 C, 2 SWS).....	12435
B.Phy.5620: Physics of Sports (4 C, 2 SWS).....	12436
B.Phy.5621: Stochastic Processes (4 C, 2 SWS).....	12437
B.Phy.5623: Theoretical Biophysics (6 C, 4 SWS).....	12438
B.Phy.5624: Introduction to Theoretical Neuroscience (4 C, 2 SWS).....	12439
B.Phy.5625: Röntgenphysik (6 C, 4 SWS).....	12440
B.Phy.5628: Pattern Formation (6 C, 4 SWS).....	12441
B.Phy.5629: Nonlinear dynamics and time series analysis (6 C, 4 SWS).....	12443
B.Phy.5631: Self-organization in physics and biology (4 C, 2 SWS).....	12444
B.Phy.5632: Current topics in turbulence research (4 C, 2 SWS).....	12445

B.Phy.5639: Optical measurement techniques (3 C, 2 SWS).....	12446
B.Phy.5642: Experimental Methods in Biophysics (3 C, 2 SWS).....	12447
B.Phy.5643: Seminar Experimental Methods in Biophysics (4 C, 2 SWS).....	12448
B.Phy.5645: Nanooptics and Plasmonics (3 C, 2 SWS).....	12449
B.Phy.5646: Climate Physics (6 C, 4 SWS).....	12450
B.Phy.5647: Physics of Coffee, Tea and other drinks (4 C, 2 SWS).....	12451
B.Phy.5648: Theoretische und computergestützte Biophysik (4 C, 2 SWS).....	12452
B.Phy.5649: Biomolecular Physics and Simulations (4 C, 2 SWS).....	12454
B.Phy.5651: Advanced Computational Neuroscience (3 C, 2 SWS).....	12455
B.Phy.5652: Advanced Computational Neuroscience II (3 C, 2 SWS).....	12456
B.Phy.5655: Komplexe Dynamik physikalischer und biologischer Systeme (4 C, 2 SWS).....	12457
B.Phy.5656: Experimental work at at large scale facilities for X-ray photons (3 C, 3 SWS).....	12458
B.Phy.5657: Biophysics of gene regulation (3 C, 2 SWS).....	12460
B.Phy.5658: Statistical Biophysics (6 C, 4 SWS).....	12461
B.Phy.5659: Seminar on current topics in theoretical biophysics (4 C, 2 SWS).....	12462
B.Phy.5660: Theoretical Biofluid Mechanics (3 C, 2 SWS).....	12463
B.Phy.5661: Biomedical Techniques in Complex Systems (4 C, 2 SWS).....	12464
B.Phy.5662: Active Soft Matter (4 C, 2 SWS).....	12465
B.Phy.5663: Stochastic Dynamics (6 C, 6 SWS).....	12466
B.Phy.5664: Excursion to DESY and the European XFEL, Hamburg (3 C, 2 SWS).....	12467
B.Phy.5665: Processing of Signals and Measured Data (3 C, 2 SWS).....	12468
B.Phy.5720: Introduction to Ultrashort Pulses and Nonlinear Optics (3 C, 2 SWS).....	12477
B.Phy.5721: Information and Physics (6 C, 6 SWS).....	12478
B.Phy.5722: Seminar on Topics in Nonlinear Optics (4 C, 2 SWS).....	12479
B.Phy.5804: Quantum mechanics II (6 C, 6 SWS).....	12482
B.Phy.5805: Quantum field theory I (6 C, 6 SWS).....	12483
B.Phy.5811: Statistical methods in data analysis (3 C, 3 SWS).....	12489
B.Phy.5901: Advanced Algorithms for Computational Physics (6 C, 4 SWS).....	12493
M.Phy.5002: Contemporary Physics (4 C, 2 SWS).....	12524
M.Phy.5601: Seminar Computational Neuroscience/Neuroinformatik (4 C, 2 SWS).....	12532

M.Phy.5604: Biomedicine imaging physics and medical physics (6 C, 4 SWS).....	12533
M.Phy.5608: Liquid State Physics (4 C, 2 SWS).....	12534
M.Phy.5609: Turbulence Meets Active Matter (4 C, 4 SWS).....	12536
M.Phy.561: Advanced Topics in Biophysics/Physics of complex systems I (6 C, 6 SWS).....	12538
M.Phy.5613: Vorlesung: Principles and Applications of Synchrotron and Free Electron Laser Radiation (3 C, 4 SWS).....	12539
M.Phy.5614: Praktikum: Principles and Applications of Synchrotron and Free Electron Laser Radiation (3 C, 2 SWS).....	12541
M.Phy.562: Advanced Topics in Biophysics/Physics of complex systems II (6 C, 4 SWS).....	12543
M.Phy.566: Seminar Advanced Topics in Biophysics/Complex Systems (4 C, 2 SWS)..	12544

### **bb. Zweiter Studienabschnitt (3. Semester)**

Es müssen folgende drei Module im Umfang von insgesamt 30 C erfolgreich absolviert werden:

M.Phy.1602: Development and Realization of Scientific Projects in Biophysics/Complex Systems (9 C).....	12508
M.Phy.1606: Networking in Biophysics/Physics of Complex Systems (3 C).....	12512
M.Phy.406: Research Lab Course in Biophysics and Physics of Complex Systems (18 C).	12516

### **c. Forschungsschwerpunkt "Festkörper- und Materialphysik"**

Es müssen Module im Umfang von insgesamt wenigstens 56 C nach Maßgabe der nachfolgenden Bestimmungen erfolgreich absolviert werden.

#### **aa. Erster Studienabschnitt (1. und 2. Semester)**

Es müssen Module im Umfang von insgesamt wenigstens 26 C nach Maßgabe der folgenden Bestimmungen erfolgreich absolviert werden.

##### **i. Forschungsseminar**

Es muss folgendes Modul im Umfang von 4 C erfolgreich absolviert werden:

M.Phy.411: Research Seminar Solid State/Materials Physics (4 C, 2 SWS).....	12521
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##### **ii. Wahlpflichtbereich A**

Es muss mindestens eines der folgenden Module im Umfang von wenigstens 6 C erfolgreich absolviert werden, soweit diese oder entsprechende Module nicht bereits im Rahmen des Bachelorstudiums erfolgreich absolviert wurden:

B.Phy.1521: Einführung in die Festkörperphysik (8 C, 6 SWS).....	12381
B.Phy.1522: Solid State Physics II (6 C, 4 SWS).....	12382



B.Phy.1531: Introduction to Materials Physics (4 C, 4 SWS)..... 12383

**iii. Wahlpflichtbereich B**

Ergänzend muss die Differenz zu den 26 C durch erfolgreiche Absolvierung wenigstens eines der folgenden Module erbracht werden; bereits im Bachelorstudium absolvierte Module können nicht berücksichtigt werden:

B.Phy.1511: Einführung in die Kern- und Teilchenphysik (8 C, 6 SWS)..... 12379

B.Phy.1541: Einführung in die Geophysik (4 C, 3 SWS)..... 12384

B.Phy.1551: Introduction to Astrophysics (8 C, 6 SWS)..... 12385

B.Phy.1561: Introduction to Physics of Complex Systems (8 C, 6 SWS)..... 12386

B.Phy.1571: Introduction to Biophysics (8 C, 6 SWS)..... 12387

B.Phy.5616: Biophysics of the cell - physics on small scales (6 C, 4 SWS)..... 12432

B.Phy.5660: Theoretical Biofluid Mechanics (3 C, 2 SWS)..... 12463

B.Phy.5665: Processing of Signals and Measured Data (3 C, 2 SWS)..... 12468

B.Phy.5701: Weiche Materie: Flüssigkristalle (3 C, 2 SWS)..... 12469

B.Phy.5702: Dünne Schichten (3 C, 2 SWS)..... 12470

B.Phy.5709: Seminar on Nanoscience (4 C, 2 SWS)..... 12471

B.Phy.5714: Introduction to Solid State Theory (6 C, 6 SWS)..... 12472

B.Phy.5716: Nano-Optics meets Strong-Field Physics (6 C, 4 SWS)..... 12473

B.Phy.5717: Mechanisms and Materials for Renewable Energy (6 C, 4 SWS)..... 12474

B.Phy.5718: Mechanisms and Materials for Renewable Energy: Photovoltaics (4 C, 2 SWS)..... 12475

B.Phy.5719: Mechanisms and Materials for Renewable Energy: Solar heat, Thermoelectric, solar fuel (4 C, 2 SWS)..... 12476

B.Phy.5720: Introduction to Ultrashort Pulses and Nonlinear Optics (3 C, 2 SWS)..... 12477

B.Phy.5721: Information and Physics (6 C, 6 SWS)..... 12478

B.Phy.5722: Seminar on Topics in Nonlinear Optics (4 C, 2 SWS)..... 12479

B.Phy.5723: Hands-on course on Density-Functional calculations 1 (3 C, 3 SWS)..... 12480

B.Phy.5724: Hands-on course on Density-Functional calculations 1+2 (6 C, 6 SWS).... 12481

B.Phy.5804: Quantum mechanics II (6 C, 6 SWS)..... 12482

B.Phy.5805: Quantum field theory I (6 C, 6 SWS)..... 12483

B.Phy.5811: Statistical methods in data analysis (3 C, 3 SWS)..... 12489

B.Phy.5901: Advanced Algorithms for Computational Physics (6 C, 4 SWS)..... 12493

M.Phy.5002: Contemporary Physics (4 C, 2 SWS).....	12524
M.Phy.5613: Vorlesung: Principles and Applications of Synchrotron and Free Electron Laser Radiation (3 C, 4 SWS).....	12539
M.Phy.5614: Praktikum: Principles and Applications of Synchrotron and Free Electron Laser Radiation (3 C, 2 SWS).....	12541
M.Phy.5701: Advanced Solid State Theory (6 C, 6 SWS).....	12545
M.Phy.5703: Materialforschung mit Elektronen (6 C, 4 SWS).....	12546
M.Phy.5705: Materials Physics I: Microstructure-Property-Relations (4 C, 3 SWS).....	12547
M.Phy.5706: Materials Physics II: Kinetics and Phase Transformations (4 C, 3 SWS)...	12548
M.Phy.5707: Materials research with electrons (3 C, 2 SWS).....	12549
M.Phy.5708: Physics of Semiconductor Devices (4 C, 2 SWS).....	12550
M.Phy.5709: Physics of Semiconductors (3 C, 2 SWS).....	12551
M.Phy.571: Advanced Topics in Solid State/Materials Physics I (6 C, 6 SWS).....	12552
M.Phy.5710: Physics of Semiconductors and Semiconductor Devices (6 C, 4 SWS).....	12553
M.Phy.5711: Surface Physics (3 C, 2 SWS).....	12554
M.Phy.5712: Topology in Condensed Matter Physics (6 C, 4 SWS).....	12555
M.Phy.572: Advanced Topics in Solid State/Materials Physics II (6 C, 4 SWS).....	12556
M.Phy.576: Seminar Advanced Topics in Solid State/Materials Physics (4 C, 2 SWS)...	12557
M.Phy.5810: Physics and Applications of Ion solid interaction (6 C, 6 SWS).....	12562
M.Phy.5811: Nuclear Solid State Physics (4 C, 2 SWS).....	12563

### **bb. Zweiter Studienabschnitt (3. Semester)**

Es müssen folgende drei Module im Umfang von insgesamt 30 C erfolgreich absolviert werden:

M.Phy.1603: Development and Realization of Scientific Projects in Solid State/Materials Physics (9 C).....	12509
M.Phy.1607: Networking in Solid State/Materials Physics (3 C).....	12513
M.Phy.407: Research Lab Course in Solid State/Materials Physics (18 C).....	12517

### **d. Forschungsschwerpunkt "Kern- und Teilchenphysik"**

Es müssen Module im Umfang von insgesamt wenigstens 56 C nach Maßgabe der nachfolgenden Bestimmungen erfolgreich absolviert werden.

#### **aa. Erster Studienabschnitt (1. und 2. Semester)**

Es müssen Module im Umfang von insgesamt wenigstens 26 C nach Maßgabe der folgenden Bestimmungen erfolgreich absolviert werden.

### **i. Forschungsseminar**

Es muss folgendes Modul im Umfang von 4 C erfolgreich absolviert werden:

M.Phys.412: Research Seminar Particle Physics (4 C, 2 SWS).....	12522
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### **ii. Wahlpflichtbereich A**

Es muss das folgende Modul im Umfang von 8 C erfolgreich absolviert werden, soweit dieses oder ein entsprechendes Modul nicht bereits im Rahmen des Bachelorstudiums erfolgreich absolviert wurde:

B.Phys.1511: Einführung in die Kern- und Teilchenphysik (8 C, 6 SWS).....	12379
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### **iii. Wahlpflichtbereich B**

Es muss mindestens eines der folgenden Module im Umfang von 6 C erfolgreich absolviert werden, soweit diese oder entsprechende Module nicht bereits im Rahmen des Bachelorstudiums erfolgreich absolviert wurden:

B.Phys.1512: Particle physics II - of and with quarks (6 C, 6 SWS).....	12380
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M.Phys.5807: Particle Physics III - of and with leptons (6 C, 6 SWS).....	12560
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### **iv. Wahlpflichtbereich C**

Ergänzend muss die Differenz zu den 26 C durch erfolgreiche Absolvierung wenigstens eines der folgenden Module erbracht werden; bereits im Bachelorstudium absolvierte Module können nicht berücksichtigt werden:

B.Phys.1521: Einführung in die Festkörperphysik (8 C, 6 SWS).....	12381
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B.Phys.1531: Introduction to Materials Physics (4 C, 4 SWS).....	12383
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B.Phys.1541: Einführung in die Geophysik (4 C, 3 SWS).....	12384
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B.Phys.1551: Introduction to Astrophysics (8 C, 6 SWS).....	12385
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B.Phys.1561: Introduction to Physics of Complex Systems (8 C, 6 SWS).....	12386
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B.Phys.1571: Introduction to Biophysics (8 C, 6 SWS).....	12387
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B.Phys.5523: General Relativity (6 C, 6 SWS).....	12411
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B.Phys.5665: Processing of Signals and Measured Data (3 C, 2 SWS).....	12468
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B.Phys.5804: Quantum mechanics II (6 C, 6 SWS).....	12482
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B.Phys.5805: Quantum field theory I (6 C, 6 SWS).....	12483
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B.Phys.5806: Spezielle Relativitätstheorie (3 C, 2 SWS).....	12484
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B.Phys.5807: Physics of particle accelerators (3 C, 3 SWS).....	12485
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B.Phys.5808: Interactions between radiation and matter - detector physics (3 C, 3 SWS)	12486
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B.Phys.5809: Hadron-Collider-Physics (3 C, 3 SWS).....	12487
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B.Phy.5810: Physics of the Higgs boson (3 C, 3 SWS).....	12488
B.Phy.5811: Statistical methods in data analysis (3 C, 3 SWS).....	12489
B.Phy.5812: Physics of the top-quark (3 C, 3 SWS).....	12490
B.Phy.5815: Seminar zu einführenden Themen der Teilchenphysik (4 C, 2 SWS).....	12491
B.Phy.5816: Phenomenology of Physics Beyond the Standard Model (3 C, 2 SWS).....	12492
B.Phy.5901: Advanced Algorithms for Computational Physics (6 C, 4 SWS).....	12493
M.Phy.5002: Contemporary Physics (4 C, 2 SWS).....	12524
M.Phy.5801: Detectors for particle physics and imaging (3 C, 3 SWS).....	12558
M.Phy.5804: Simulation methods for theoretical particle physics (3 C, 3 SWS).....	12559
M.Phy.581: Advanced Topics in Nuclear and Particle Physics I (6 C, 6 SWS).....	12561
M.Phy.5810: Physics and Applications of Ion solid interaction (6 C, 6 SWS).....	12562
M.Phy.5811: Nuclear Solid State Physics (4 C, 2 SWS).....	12563
M.Phy.5812: Nuclear Reactor Physics (4 C, 4 SWS).....	12564
M.Phy.582: Advanced Topics in Particle Physics II (6 C, 4 SWS).....	12565
M.Phy.586: Seminar Advanced Topics in Particle Physics (4 C, 2 SWS).....	12566

### **bb. Zweiter Studienabschnitt (3. Semester)**

Es müssen folgende drei Module im Umfang von insgesamt 30 C erfolgreich absolviert werden:

M.Phy.1604: Development and Realization of Scientific Projects in Nuclear/Particle Physics (9 C).....	12510
M.Phy.1608: Networking in Nuclear/Particle Physics (3 C).....	12514
M.Phy.408: Research Lab Course in Nuclear and Particle Physics (18 C).....	12518

### **3. Profilierungsbereich**

Es müssen Module im Umfang von insgesamt wenigstens 22 C nach Maßgabe der nachfolgenden Bestimmungen erfolgreich absolviert werden.

#### **a. Profilierungsseminar**

Es muss folgendes Pflichtmodul im Umfang von 4 C erfolgreich absolviert werden:

M.Phy.413: General Seminar (4 C, 2 SWS).....	12523
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#### **b. Profilierungsbereich Mathematik-Naturwissenschaften**

Es müssen aus dem Lehrangebot der mathematisch-naturwissenschaftlichen Fakultäten (inkl. Fakultät für Physik) Module im Umfang von insgesamt wenigstens 6 C erfolgreich absolviert werden. Wählbar sind insbesondere nach Nr. 2 nicht eingebrachte Module sowie die nachfolgenden Module; darüber hinaus wird ein Verzeichnis wählbarer Module durch die Fakultät

für Physik in geeigneter Weise bekannt gemacht. Bachelormodule können nur eingebracht werden, sofern sie nicht bereits im Rahmen des Bachelorstudiums erfolgreich absolviert wurden.

B.Che.1302.1: Chemisches Gleichgewicht: Thermodynamik und Statistik (MaW) (6 C, 4 SWS).....	12369
B.Che.2301: Chemische Reaktionskinetik (6 C, 4 SWS).....	12370
B.Che.4104: Allgemeine und Anorganische Chemie (Lehramt und Nebenfach) (6 C, 6 SWS).	12371
B.Che.8002: Einführung in die Physikalische Chemie für Studierende der Biologie und Geowissenschaften (10 C, 7 SWS).....	12372
B.Che.9107: Chemisches Praktikum für Studierende der Physik und Geowissenschaften (6 C, 8 SWS).....	12373
B.Inf.1101: Informatik I (10 C, 6 SWS).....	12375
B.Inf.1102: Informatik II (10 C, 6 SWS).....	12377
B.Phy.1603: Vermittlung wissenschaftlicher Zusammenhänge durch neue Medien (4 C, 2 SWS).....	12388
B.Phy.1604: Projektpraktikum (6 C, 6 SWS).....	12389
B.Phy.1609: Grundlagen zur Einheit von Mensch und Natur (4 C, 2 SWS).....	12390
B.Phy.5902: Physik für BundeskanzlerInnen, ManagerInnen und BürgerInnen (3 C, 2 SWS)..	12494
B.Phy.606: Electronic Lab Course for Natural Scientists (6 C, 6 SWS).....	12495
B.Phy.607: Akademisches Schreiben für Physiker/innen (4 C, 2 SWS).....	12496
B.Phy.608: Scientific Literacy - Integration von Naturwissenschaften in die Gesellschaft und Politik (4 C, 2 SWS).....	12497
M.Che.1314: Biophysikalische Chemie (6 C, 4 SWS).....	12499
M.Phy.603: Writing scientific articles (6 C, 2 SWS).....	12567

## **c. Profilierungsbereich Nicht-Physikalisch**

Es müssen Module im Umfang von insgesamt wenigstens 12 C aus dem Lehrangebot der Universität außerhalb der Fakultät für Physik erfolgreich absolviert werden. Wählbar sind Angebote aufgrund der Prüfungsordnung für Studienangebote der Zentralen Einrichtung für Sprachen und Schlüsselqualifikationen (ZESS); darüber hinaus wird ein Verzeichnis wählbarer Module durch die Fakultät für Physik in geeigneter Weise bekannt gemacht.

B.Che.1302.1: Chemisches Gleichgewicht: Thermodynamik und Statistik (MaW) (6 C, 4 SWS).....	12369
B.Che.2301: Chemische Reaktionskinetik (6 C, 4 SWS).....	12370
B.Che.8002: Einführung in die Physikalische Chemie für Studierende der Biologie und Geowissenschaften (10 C, 7 SWS).....	12372
B.Che.9107: Chemisches Praktikum für Studierende der Physik und Geowissenschaften (6 C, 8 SWS).....	12373
B.Inf.1101: Informatik I (10 C, 6 SWS).....	12375

B.Inf.1102: Informatik II (10 C, 6 SWS).....	12377
B.SK-Phy.9001: Papers, Proposals, Presentations: Skills of Scientific Communication (4 C, 2 SWS).....	12498
M.Che.1314: Biophysikalische Chemie (6 C, 4 SWS).....	12499

#### **d. Alternativmodule**

Anstelle der Module nach Buchstaben a und b können auf Antrag, der an die Studiendekanin oder den Studiendekan der Fakultät für Physik zu richten ist, andere Module (Alternativmodule) nach Maßgabe der nachfolgenden Bestimmungen absolviert werden. Dem Antrag ist die Zustimmung der Studiendekanin oder des Studiendekans der Fakultät oder Lehrinheit, die das Alternativmodul anbietet, beizufügen. Die Entscheidung trifft die Studiendekanin oder der Studiendekan der Fakultät für Physik. Der Antrag kann ohne Angabe von Gründen abgelehnt werden; ein Rechtsanspruch der Antragstellerin oder des Antragstellers auf Zulassung eines Alternativmoduls besteht nicht.

#### **4. Masterarbeit**

Durch die erfolgreiche Anfertigung der Masterarbeit werden 30 C erworben.

### **II. Erasmus-Mundus-Joint-Degree-Option "AstroMundus"**

Studierende des Erasmus-Mundus-Joint-Degree-Programms in Astrophysik (AstroMundus) müssen abweichend von Nr. I 120 C nach Maßgabe der nachfolgenden Bestimmungen erwerben.

#### **1. Erster Studienabschnitt**

Es müssen Module des ersten Studienabschnitts im Umfang von insgesamt 60 C an der Leopold-Franzens-Universität Innsbruck sowie der Università degli Studi di Padova oder der Università degli Studi di Roma "Tor Vergata" nach Maßgabe der dort geltenden prüfungsrechtlichen Bestimmungen erfolgreich absolviert werden.

#### **2. Zweiter Studienabschnitt**

##### **a. Pflichtmodule**

Es müssen nachfolgende Module im Umfang von insgesamt 30 C erfolgreich absolviert werden:

M.Phy-AM.001: Active Galactic Nuclei (6 C, 2 SWS).....	12500
M.Phy-AM.002: Stellar structure and evolution (6 C, 2 SWS).....	12501
M.Phy-AM.003: Stellar Atmosphere (6 C, 4 SWS).....	12502
M.Phy-AM.012: Astrophysical Properties: From planets to cosmology (12 C, 8 SWS).....	12503

##### **b. Masterarbeit**

Durch die erfolgreiche Anfertigung der Masterarbeit werden 25 C erworben.

##### **c. Kolloquium zur Masterarbeit**

Durch das erfolgreiche Absolvieren des Kolloquiums zur Master-Arbeit werden 5 C erworben.

### **III. Ergänzende Hinweise zu Modulprüfungen**

Soweit in diesem Modulverzeichnis Modulbeschreibungen in englischer Sprache veröffentlicht werden, gilt für die verwendeten Prüfungsformen nachfolgende Zuordnung:

written exam - Klausur

written/supplementary report/elaboraton - schriftliche/-r Bericht/Ausarbeitung

presentation - Präsentation

term paper - Hausarbeit

oral exam - mündliche Prüfung

handout -Handout

lecture/talk - Vortrag

report - Protokoll

<b>Georg-August-Universität Göttingen</b>		6 C 4 SWS
<b>Modul B.Che.1302.1: Chemisches Gleichgewicht: Thermodynamik und Statistik (MaW)</b>		
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Abschluss des Moduls kann der Studierende ... <ul style="list-style-type: none"> <li>- die physikalische Bedeutung grundlegender Größen und Gesetze der Thermodynamik sowie ihre statistisch-mechanischen Grundlagen verstehen und mit ihrer mathematischen Formulierung umgehen;</li> <li>- diese Gesetze auf reversible und irreversible Zustandsänderungen von 1-Stoff-Systemen und Mischungen anwenden;</li> <li>- Phasen- und Reaktionsgleichgewichte berechnen;</li> <li>- elektrochemische Potentiale auf der Basis von Elektrolyteigenschaften quantitativ bestimmen;</li> <li>- thermodynamische Zustandsgrößen auf der Basis molekularer Eigenschaften berechnen;</li> </ul>		<b>Arbeitsaufwand:</b> Präsenzzeit: 56 Stunden Selbststudium: 124 Stunden
<b>Lehrveranstaltungen:</b> <b>1. Vorlesung Chemisches Gleichgewicht</b> (Vorlesung) <b>2. Proseminar Chemisches Gleichgewicht</b> <b>3. Übungen zur Vorlesung Chemisches Gleichgewicht</b>		2 SWS 1 SWS 1 SWS
<b>Prüfung: Klausur (180 Minuten)</b> <b>Prüfungsvorleistungen:</b> 12 Hausaufgaben (HA) sowie 12 Kurztests (KT) werden zur Bearbeitung angeboten; das mit 1/3 gewichtete Ergebnis der HA und das mit 2/3 gewichtete Ergebnis der KT muss insges. mind. 65% der erreichbaren Punkte ergeben. Details siehe Skript o. UniVz		6 C
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Jörg Schroeder	
<b>Angebotshäufigkeit:</b> jedes Sommersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b>	
<b>Maximale Studierendenzahl:</b> 100		



<b>Georg-August-Universität Göttingen</b>		6 C 4 SWS
<b>Modul B.Che.2301: Chemische Reaktionskinetik</b> <i>English title: Kinetics of Chemical Reactions</i>		
<b>Lernziele/Kompetenzen:</b> Die Studierenden können chemische Elementarreaktionen, Transportvorgänge und Reaktionsmechanismen in verschiedenen Aggregatzuständen analysieren bzw. auf molekularer Basis verstehen. Sie sind mit Anwendungen der Reaktionskinetik in Gebieten wie der Photochemie, Atmosphärenchemie und Umweltchemie vertraut.	<b>Arbeitsaufwand:</b> Präsenzzeit: 56 Stunden Selbststudium: 124 Stunden	
<b>Lehrveranstaltungen:</b>		
<b>1. Vorlesung: Chemische Reaktionskinetik</b> (Vorlesung)		2 SWS
<b>2. Proseminar: Chemische Reaktionskinetik</b>		1 SWS
<b>3. Übung zu: Chemische Reaktionskinetik</b> (Übung)		1 SWS
<b>Prüfung: Klausur (180 Minuten)</b>		
<b>Prüfungsanforderungen:</b> Formale Reaktionskinetik, experimentelle Methoden der Reaktionskinetik, theoretische Beschreibung von Elementarreaktionen und Transportvorgängen, Anwendungen der Reaktionskinetik		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Alec Wodtke	
<b>Angebotshäufigkeit:</b> jedes Wintersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b>	
<b>Maximale Studierendenzahl:</b> 100		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Che.4104: Allgemeine und Anorganische Chemie (Lehramt und Nebenfach)</b> <i>English title: Introduction to General and Inorganic Chemistry</i>		6 C 6 SWS
<b>Lernziele/Kompetenzen:</b> Die Studierenden verstehen die allgemeinen Prinzipien und Gesetzmäßigkeiten der Chemie und sind mit grundlegenden Begriffen der allgemeinen und anorganischen Chemie vertraut. Sie erwerben erste Kenntnisse der anorganischen Stoffchemie.	<b>Arbeitsaufwand:</b> Präsenzzeit: 84 Stunden Selbststudium: 96 Stunden	
<b>Lehrveranstaltungen:</b> 1. "Experimentalchemie I (Allgemeine und Anorganische Chemie)" (Vorlesung) 2. "Experimentalchemie I (Allgemeine und Anorganische Chemie)" (Übung)	4 SWS 2 SWS	
<b>Prüfung: Klausur (120 Minuten)</b> <b>Prüfungsvorleistungen:</b> Erfolgreiche Teilnahme an den Übungen; Näheres regelt die Übungs-Ordnung	6 C	
<b>Prüfungsanforderungen:</b> Allgemeine Chemie: Atombau und Periodensystem, Elemente und Verbindungen, Chemische Gleichungen und Stöchiometrie, Lösungen und Lösungsvorgänge, chemische Gleichgewichte, einfache Thermodynamik und Kinetik, Säure-Base-Reaktionen, Fällungs- und Komplexbildungsreaktionen, Redoxreaktionen; Grundlagen der Anorganischen Chemie: Vorkommen, Darstellung, Eigenschaften einiger Elemente und ihrer wichtigsten Verbindungen.		
<b>Zugangsvoraussetzungen:</b> Keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Dietmar Stalke	
<b>Angebotshäufigkeit:</b> jedes Wintersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b>	

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Che.8002: Einführung in die Physikalische Chemie für Studierende der Biologie und Geowissenschaften</b> <i>English title: Introduction to Physical Chemistry for Biology and Geosciences</i>		10 C 7 SWS
<b>Lernziele/Kompetenzen:</b> In Rahmen dieses Moduls erlangen die Studierenden ein grundlegendes Verständnis des chemischen Gleichgewichts, der chemischen Kinetik sowie der Elektrochemie unter besonderer Berücksichtigung von Anwendungen im biologisch-medizinischen Bereich.		<b>Arbeitsaufwand:</b> Präsenzzeit: 98 Stunden Selbststudium: 202 Stunden
<b>Lehrveranstaltungen:</b> <b>1. Einführung in die Physikalische Chemie für Studierende der Biologie und Geowissenschaften</b> (Vorlesung) <b>2. Einführung in die Physikalische Chemie für Studierende der Biologie und Geowissenschaften</b> (Übung) <b>3. Einführung in die Physikalische Chemie für Studierende der Biologie und Geowissenschaften</b> (Seminar)		2 SWS  2 SWS  3 SWS
<b>Prüfung: Klausur (180 Minuten)</b> <b>Prüfungsvorleistungen:</b> Erfolgreiche Teilnahme an den Übungen und dem Seminar (Die Seminararbeit kann nach der Klausur abgegeben werden).		10 C
<b>Prüfungsanforderungen:</b> Hauptsätze der Thermodynamik, reale Gase, Thermochemie, chemisches Gleichgewicht, Phasengleichgewicht, Phasendiagramme, Elektrolytlösungen, elektrochemisches Gleichgewicht und EMK, formale Kinetik, Enzymkinetik, Arrhenius-Gesetz, Theorie des Übergangszustandes.		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> Modul "Mathematische Grundlagen in der Biologie"	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Andreas Janshoff	
<b>Angebotshäufigkeit:</b> jedes Wintersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> 4	
<b>Maximale Studierendenzahl:</b> 40		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Che.9107: Chemisches Praktikum für Studierende der Physik und Geowissenschaften</b> <i>English title: Laboratory course in General and Inorganic Chemistry for Physicists and Geologists</i>		6 C 8 SWS
<b>Lernziele/Kompetenzen:</b> Verstehen der allgemeinen Prinzipien und Gesetzmäßigkeiten der allgemeinen und anorganischen Chemie, sicherer Umgang mit deren Begriffen. Anwendung der im Modul B.Che.4104 erworbenen Kenntnisse der anorganischen Stoffchemie, Kennenlernen experimenteller Arbeitstechniken anhand von Schlüsselreaktionen. Integrative Vermittlung von Schlüsselkompetenzen: Teamarbeit; gute wissenschaftliche Praxis; Protokollführung; sicheres Arbeiten im Labor.		<b>Arbeitsaufwand:</b> Präsenzzeit: 112 Stunden Selbststudium: 68 Stunden
<b>Lehrveranstaltungen:</b> <b>1. Chemisches Praktikum für Studierende der Physik und Geowissenschaften</b> <i>Angebotshäufigkeit: jedes Semester</i> <b>2. Seminar zum Chemischen Praktikum für Studierende der Physik und Geowissenschaften (Seminar)</b> <i>Angebotshäufigkeit: jedes Semester</i>		6 SWS  2 SWS
<b>Prüfung: Klausur (120 Minuten)</b> <b>Prüfungsvorleistungen:</b> Erfolgreiche Teilnahme am Praktikum, Details siehe Praktikumsordnung <b>Prüfungsanforderungen:</b> Atombau und Periodensystem, Grundbegriffe, Elemente und Verbindungen, Aufbau der Materie, einfache Bindungskonzepte, Chemische Gleichungen und Stöchiometrie, Chemische Gleichgewichte, einfache Thermodynamik und Kinetik, Säure-Base-Reaktionen inklusive Puffer, Redoxreaktionen, Löslichkeit, einfache Elektrochemie, Vorkommen, Darstellung und Eigenschaften der Elemente und ihrer wichtigsten Verbindungen, Einführung in spektroskopische Methoden.		6 C
<b>Zugangsvoraussetzungen:</b> B.Che.4104	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Franc Meyer	
<b>Angebotshäufigkeit:</b> jedes Wintersemester (Blockpraktikum in vorlesungsfreier Zeit) und jedes Sommersemester (in der Vorlesungszeit)	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b>	
<b>Bemerkungen:</b> Das Seminar wird von den Dozierenden und Assistent/innen der Anorganischen Chemie durchgeführt.		

Ansprechpersonen für das Praktikum sind Frau Dr. Stückl sowie die entsprechenden Assistent/innen.

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Inf.1101: Informatik I</b> <i>English title: Computer Science I</i>	10 C 6 SWS
<b>Lernziele/Kompetenzen:</b> Studierende <ul style="list-style-type: none"> <li>• kennen grundlegende Begriffe, Prinzipien und Herangehensweisen der Informatik, kennen einige Programmierparadigmen und Grundzüge der Objektorientierung.</li> <li>• erlangen elementare Grundkenntnisse der Aussagenlogik, verstehen die Bedeutung für Programmsteuerung und Informationsdarstellung und können sie in einfachen Situationen anwenden.</li> <li>• verstehen wesentliche Funktionsprinzipien von Computern und der Informationsdarstellung und deren Konsequenzen für die Programmierung.</li> <li>• erlernen die Grundlagen einer Programmiersprache und können einfache Algorithmen in dieser Sprache codieren.</li> <li>• kennen einfache Datenstrukturen und ihre Eignung in typischen Anwendungssituationen, können diese programmtechnisch implementieren.</li> <li>• analysieren die Korrektheit einfacher Algorithmen und bewerten einfache Algorithmen und Probleme nach ihrem Ressourcenbedarf.</li> </ul>	<b>Arbeitsaufwand:</b> Präsenzzeit: 84 Stunden Selbststudium: 216 Stunden
<b>Lehrveranstaltung: Informatik I (Vorlesung, Übung)</b>	6 SWS
<b>Prüfung: Klausur (90 Minuten) oder mündliche Prüfung (ca. 20 Min.)</b> <b>Prüfungsvorleistungen:</b> Nachweis von 50% der in den Übungsaufgaben erreichbaren Punkte. Kontinuierliche Teilnahme an den Übungen. <b>Prüfungsanforderungen:</b> In der Prüfung wird das Verständnis der vermittelten Grundbegriffe sowie die aktive Beherrschung der vermittelten Inhalte und Techniken nachgewiesen, z.B. <ul style="list-style-type: none"> <li>• Kenntnis von Grundbegriffen nachweisen durch Umschreibung in eigenen Worten.</li> <li>• Standards der Informationsdarstellung in konkreter Situation umsetzen.</li> <li>• Ausdrücke auswerten oder Bedingungen als logische Ausdrücke formulieren usw.</li> <li>• Programmablauf auf gegebenen Daten geeignet darstellen.</li> <li>• Programmcode auch in nicht offensichtlichen Situationen verstehen.</li> <li>• Fehler im Programmcode erkennen/korrigieren/klassifizieren.</li> <li>• Datenstrukturen für einfache Anwendungssituationen auswählen bzw. geeignet in einem Kontext verwenden.</li> <li>• Algorithmen für einfache Probleme auswählen und beschreiben (ggf. nach Hinweisen) und/oder einen vorgegebenen Algorithmus (ggf. fragmentarisch) programmieren bzw. ergänzen.</li> <li>• einfache Algorithmen/Programme nach Ressourcenbedarf analysieren.</li> <li>• einfachsten Programmcode auf Korrektheit analysieren.</li> <li>• einfache Anwendungssituation geeignet durch Modul- oder Klassenschnittstellen modellieren.</li> </ul>	10 C
<b>Zugangsvoraussetzungen:</b>	<b>Empfohlene Vorkenntnisse:</b>

keine	keine
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Carsten Damm
<b>Angebotshäufigkeit:</b> jedes Wintersemester	<b>Dauer:</b> 1 Semester
<b>Wiederholbarkeit:</b> zweimalig	<b>Empfohlenes Fachsemester:</b> ab bis
<b>Maximale Studierendenzahl:</b> 300	

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Inf.1102: Informatik II</b> <i>English title: Computer Science II</i>		10 C 6 SWS
<b>Lernziele/Kompetenzen:</b> Die Studierenden <ul style="list-style-type: none"> <li>• beherrschen die Grundlagen einer deklarativen Programmiersprache und können Programme erstellen, testen und analysieren.</li> <li>• kennen die Bausteine und den Aufbau von Schaltnetzen und Schaltwerken, sie können Schaltnetze und Schaltwerke konstruieren und analysieren.</li> <li>• kennen die Komponenten und Konzepte der Von-Neumann-Architektur und den Aufbau einer konkreten Mikroprozessor-Architektur (z.B. MIPS-32), sie beherrschen die zugehörige Maschinensprache und können Programme erstellen und analysieren.</li> <li>• kennen Aufgaben und Struktur eines Betriebssystems, die Verfahren zur Verwaltung, Scheduling und Synchronisation von Prozessen und zur Speicherverwaltung, sie können diese Verfahren jeweils anwenden, analysieren und vergleichen.</li> <li>• kennen Grundlagen und verschiedene Beschreibungen (z.B. Automaten und Grammatiken) von formalen Sprachen, sie können die Beschreibungen konstruieren, analysieren und vergleichen.</li> <li>• kennen die Syntax und Semantik von Aussagen- und Prädikatenlogik, sie können Formeln bilden und auswerten, sowie das Resolutionskalkül anwenden.</li> <li>• kennen die Schichtenarchitektur von Computernetzwerken, sie kennen Dienste und Protokolle und können diese analysieren und vergleichen.</li> <li>• kennen symmetrische und asymmetrische Verschlüsselungsverfahren und können diese anwenden, analysieren und vergleichen.</li> </ul>		<b>Arbeitsaufwand:</b> Präsenzzeit: 84 Stunden Selbststudium: 216 Stunden
<b>Lehrveranstaltung: Informatik II (Vorlesung, Übung)</b>		6 SWS
<b>Prüfung: Klausur (90 Minuten)</b> <b>Prüfungsvorleistungen:</b> Nachweis von 50% der in den Übungsaufgaben erreichbaren Punkte. Kontinuierliche Teilnahme an den Übungen. <b>Prüfungsanforderungen:</b> Deklarative Programmierung, Schaltnetze und Schaltwerke, Maschinensprache, Betriebssysteme, Automaten und Formale Sprachen, Prädikatenlogik, Telematik, Kryptographie		10 C
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> B.Inf.1101	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Dr. Henrik Brosenne	
<b>Angebotshäufigkeit:</b> jedes Sommersemester	<b>Dauer:</b> 1 Semester	



<b>Wiederholbarkeit:</b> zweimalig	<b>Empfohlenes Fachsemester:</b>
<b>Maximale Studierendenzahl:</b> 300	

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phys.1511: Einführung in die Kern- und Teilchenphysik</b> <i>English title: Introduction to Particle Physics</i>		8 C 6 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls kennen die Studierenden physikalische Fakten und Modellvorstellungen über den Aufbau der Atomkerne und die Eigenschaften von Elementarteilchen. Außerdem sollten sie mit den grundlegenden Begriffen und Modellen der Kern- und Teilchenphysik umgehen können.		<b>Arbeitsaufwand:</b> Präsenzzeit: 84 Stunden Selbststudium: 156 Stunden
<b>Lehrveranstaltung: Einführung in die Kern- und Teilchenphysik</b>		
<b>Prüfung: Klausur (120 Min.) oder mdl. Prüfung (ca. 30 Min.)</b> <b>Prüfungsvorleistungen:</b> Mindestens 50% der Hausaufgaben in den Übungen müssen bestanden worden sein.		8 C
<b>Prüfungsanforderungen:</b> Eigenschaften und Spektroskopie von stabilen und instabilen Atomkernen; Eigenschaften von Elementarteilchen und Experimente der Hochenergiephysik; Grundlagen der Teilchenbeschleunigerphysik.		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> StudiendekanIn der Fakultät für Physik	
<b>Angebotshäufigkeit:</b> jedes Wintersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> 5 - 6	
<b>Maximale Studierendenzahl:</b> 180		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module B.Phy.1512: Particle physics II - of and with quarks</b>		6 WLH
<b>Learning outcome, core skills:</b> After successful completion of this module, students should be familiar with the properties and interactions of quarks as well as with experimental methods and experiments which lead to their discovery and are used for precise studies.		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Courses:</b> <b>1. Particle physics II - of and with quarks</b> (Lecture)		4 WLH
<b>2. Particle physics II - of and with quarks</b> (Exercise)		2 WLH
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> Concepts and methods along with specific implementations of statistical methods in data analysis. Properties and discovery of quarks, discovery of W and Z bosons at hadron colliders, the top-quark, CKM mixing matrix, decays of heavy quarks, quark mixing and oscillations, CP-violation, jets, gluons and fragmentation, deep-inelastic scattering, QCD tests and measurement of the strong coupling $\alpha_s$ .		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Nuclear/Particle Physics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Arnulf Quadt	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 6; Master: 1 - 2	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.1521: Einführung in die Festkörperphysik</b> <i>English title: Introduction to Solid State Physics</i>		8 C 6 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden mit den grundlegenden Begriffen, Phänomenen und Modellen der Festkörperphysik umgehen können.		<b>Arbeitsaufwand:</b> Präsenzzeit: 84 Stunden Selbststudium: 156 Stunden
<b>Lehrveranstaltung: Vorlesung und Übung Einführung in die Festkörperphysik</b>		
<b>Prüfung: Klausur (120 min.) oder mdl. Prüfung (ca. 30 min.)</b> <b>Prüfungsvorleistungen:</b> Mindestens 50% der Hausaufgaben in den Übungen müssen bestanden worden sein. <b>Prüfungsanforderungen:</b> Grundlagen, Phänomene und Modelle für Elektronen- und Gitterdynamik in Festkörpern. Chemische Bindung in Festkörpern, Atomare Kristallstruktur, Streuung an periodischen Strukturen, das Elektronengas ohne Wechselwirkung: Freie Elektronen, das Elektronengas mit Wechselwirkung: Abschirmung, Plasmonen, das periodische Potential: Kristall-Elektronen, Gitterschwingungen: Phononen		8 C
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> StudiendekanIn der Fakultät für Physik	
<b>Angebotshäufigkeit:</b> jedes Wintersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> 5 - 6	
<b>Maximale Studierendenzahl:</b> 120		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module B.Phy.1522: Solid State Physics II</b>		4 WLH
<b>Learning outcome, core skills:</b> After successful completion of this Module students will be able to work with advanced concepts, phenomena and models of solid state physics.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Solid State Physics II</b>		
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> Examination topics: Basics, phenomena and models for electrons and lattice dynamics in solids. Concepts of quasi-particle interaction: Transport phenomena incl. electrical and thermal conductivity, dielectric properties. Semiconductors, magnetic properties of solids, superconductivity.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to solid state physics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> StudiendekanIn der Fakultät für Physik	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 6; Master: 1 - 2	
<b>Maximum number of students:</b> 120		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module B.Phy.1531: Introduction to Materials Physics</b>		4 WLH
<p><b>Learning outcome, core skills:</b> This 2 week long intensive course is offered between the winter and summer semesters. It applies the knowledge obtained in the Einführung in die Festkörperphysik and Thermodynamik und statistische Physik to understanding the structure, properties and dynamic behavior of the materials we use in our everyday lives.</p> <p><b>Learning outcomes:</b> crystal defects, disordered systems, impurities, crystalline mixtures and alloys, phase diagrams, phase transformations, diffusion, kinetics, materials selection, structure-property relations.</p> <p><b>Core skills:</b> The students will gain an understanding of the different materials classes that we use in everyday life, including: how properties of materials are determined by their atomic scale structure, which driving forces determine the structure of equilibrium phases, and how kinetic processes control phase transformations and the dynamics of non-equilibrium processes.</p>		<p><b>Workload:</b> Attendance time: 56 h Self-study time: 64 h</p>
<p><b>Courses:</b></p> <p>1. <b>Introduction to Materials Physics</b> (Lecture)</p> <p>2. <b>Introduction to Materials Physics</b> (Exercise)</p>		<p>2 WLH</p> <p>2 WLH</p>
<p><b>Examination: Written or oral exam, Written exam (120 minutes) or oral examination (approximately 30 minutes)</b></p> <p><b>Examination prerequisites:</b> 50% of the homework problems must be solved successfully.</p> <p><b>Examination requirements:</b> Crystal defects, disordered systems, impurities, crystalline mixtures and alloys, phase diagrams, phase transformations, diffusion, kinetics, materials selection.</p>		4 C
<p><b>Admission requirements:</b> none</p>	<p><b>Recommended previous knowledge:</b></p> <ul style="list-style-type: none"> <li>• Experimentelle Methoden der Materialphysik,</li> <li>• Einführung in die Festkörperphysik,</li> <li>• Thermodynamik und statistische Physik</li> </ul>	
<p><b>Language:</b> English</p>	<p><b>Person responsible for module:</b> Prof.in Cynthia Volkert</p>	
<p><b>Course frequency:</b> each winter semester</p>	<p><b>Duration:</b> 1 semester[s]</p>	
<p><b>Number of repeat examinations permitted:</b> three times</p>	<p><b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1</p>	
<p><b>Maximum number of students:</b> 30</p>		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.1541: Einführung in die Geophysik</b> <i>English title: Introduction to Geophysics</i>		4 C 3 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls können die Studierenden mit den grundlegenden Begriffen und Modellen der Geophysik umgehen: <ul style="list-style-type: none"> <li>• Treibhauseffekt</li> <li>• Gravimetrie</li> <li>• Seismologie</li> <li>• Elektromagnetische Tiefenforschung</li> <li>• Altersbestimmung</li> <li>• Gezeiten</li> <li>• Konvektion</li> <li>• Erdmagnetfeld</li> <li>• Fraktale und chaotische Prozesse</li> <li>• Plattentektonik</li> </ul>		<b>Arbeitsaufwand:</b> Präsenzzeit: 42 Stunden Selbststudium: 78 Stunden
<b>Lehrveranstaltung: Vorlesung und Übung zu Einführung in die Geophysik</b>		
<b>Prüfung: Klausur (120 min.) oder mdl. Prüfung (ca. 30 min.)</b> <b>Prüfungsvorleistungen:</b> Mindestens 50% der Hausaufgaben in den Übungen müssen bestanden worden sein. <b>Prüfungsanforderungen:</b> Grundlagen der Geophysik, insbes. Plattentektonik, Erdbeben		4 C
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Karsten Bahr	
<b>Angebotshäufigkeit:</b> jedes Sommersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 6; Master: 1 - 2	
<b>Maximale Studierendenzahl:</b> 120		

<b>Georg-August-Universität Göttingen</b>		8 C
<b>Module B.Phy.1551: Introduction to Astrophysics</b>		6 WLH
<b>Learning outcome, core skills:</b> After successful completion of the module students are familiar with the basic concepts of astrophysics in observation and theory. In particular, they <ul style="list-style-type: none"> <li>• have gained an overview of observational techniques in astronomy</li> <li>• understand the basic physics of the formation, structure and evolution of stars and planets have learned about the classification and structure of normal and active galaxies</li> <li>• understand the basic physics of homogeneous cosmology and cosmological structure formation</li> </ul>		<b>Workload:</b> Attendance time: 84 h Self-study time: 156 h
<b>Course: Lecture and exercises for introduction to astrophysics</b>		
<b>Examination: oral (approx. 30 minutes) or written (120 min.) exam</b> <b>Examination prerequisites:</b> At least 50% of the homework of the excercises have to be solved successfully. <b>Examination requirements:</b> Observational techniques, Planets and exoplanets, planet formation, stellar formation, structure and evolution, galaxies, AGN and quasars, cosmology, structure formation		8 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Jens Niemeyer	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1	
<b>Maximum number of students:</b> 120		



<b>Georg-August-Universität Göttingen</b>		8 C 6 WLH
<b>Module B.Phy.1561: Introduction to Physics of Complex Systems</b>		
<b>Learning outcome, core skills:</b> Sound knowledge of essential methods and concepts from Nonlinear Dynamics and Complex Systems Theory, including practical skills for analysis and simulation (using, for example, the programming language python) of dynamical systems.		<b>Workload:</b> Attendance time: 84 h Self-study time: 156 h
<b>Courses:</b>		
1. <b>Introduction to Physics of Complex Systems</b> (Lecture)		4 WLH
2. <b>Introduction to Physics of Complex Systems</b> (Exercise)		2 WLH
<b>Examination: written examination (120 Min.) or oral examination (approx. 30 Min.)</b>		8 C
<b>Examination prerequisites:</b> At least 50% of the homework of the excercises have to be solved successfully.		
<b>Examination requirements:</b> <ul style="list-style-type: none"> <li>• Knowledge of fundamental principles and methods of Nonlinear Physics</li> <li>• Modern experimental techniques and theoretical models of Complex Systems theory.</li> </ul>		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basic programming skills (for the exercises)	
<b>Language:</b> English, German	<b>Person responsible for module:</b> apl. Prof. Dr. Ulrich Parlitz	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 2	
<b>Maximum number of students:</b> 120		

<b>Georg-August-Universität Göttingen</b>		8 C 6 WLH
<b>Module B.Phy.1571: Introduction to Biophysics</b>		
<b>Learning outcome, core skills:</b> After attending this course, students will be familiar with basic concepts and phenomena, theoretical descriptions, and experimental methods in biophysics.		<b>Workload:</b> Attendance time: 84 h Self-study time: 156 h
<b>Courses:</b> <b>1. Introduction to Biophysics (Lecture)</b> <i>Contents:</i> components of the cell; diffusion, Brownian motion and random walks; low Reynolds number hydrodynamics; chemical reactions, cooperativity and enzymes; biomolecular interaction forces and self-assembly; membranes; polymer physics and mechanics of the cytoskeleton; neurobiophysics; experimental methods and microscopy <b>2. Introduction to Biophysics (Exercise)</b>		4 WLH          2 WLH
<b>Examination: Written exam (120 min.) or oral exam (ca. 30 min.)</b> <b>Examination prerequisites:</b> At least 50% of the homework of the exercises have to be solved successfully. <b>Examination requirements:</b> Knowledge of the fundamental principles, theoretical descriptions and experimental methods of biophysics.		8 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Jörg Enderlein	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 2	
<b>Maximum number of students:</b> 100		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.1603: Vermittlung wissenschaftlicher Zusammenhänge durch neue Medien</b> <i>English title: Procurement of scientific phenomena via new media</i>		4 C 2 SWS
<b>Lernziele/Kompetenzen:</b> In dieser Veranstaltung werden Grundkonzepte und Regeln des Videofilms physikalischer/naturwissenschaftlicher Phänomene vermittelt, treatments erstellt, und das Drehen von Filmen handwerklich geübt. Physikalische Phänomene z.B. aus der Physik-Show "Zauberhafte Physik" werden gefilmt und in Kombination mit Archivmaterial zu kurzen Video-Clips zusammengeschnitten. Dabei wird unter anderem ein Schwerpunkt auf die allgemeinverständliche physikalische Erklärung (Pädagogik) gelegt. Es wurden aber auch formale Aspekte im Umgang mit Medien wie Copyrights, GEMA-Gebühren, Rechte am eigenen Bild etc. vermittelt. Die Video-Clips werden nach Abnahme durch die Seminarleitung und die Presseabteilung in den offiziellen Youtube-Kanal der Georg-August-Universität Göttingen gestellt. Beispiele aus vergangenen Semester sind unter „Zauberhafte Physik“ auf <a href="http://www.youtube.de">http://www.youtube.de</a> zu finden.		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 92 Stunden
<b>Lehrveranstaltung: Seminar (Seminar)</b>		
<b>Prüfung: Vortrag (ca. 30 Minuten)</b> <b>Prüfungsvorleistungen:</b> Aktive Teilnahme <b>Prüfungsanforderungen:</b> Physikalische/wissenschaftliche Zusammenhänge allgemeinverständlich und unterstützt durch den Einsatz von selbstgedrehten Videofilmen erklären zu können.		4 C
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch, Englisch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Arnulf Quadt	
<b>Angebotshäufigkeit:</b> jedes Wintersemester1	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximale Studierendenzahl:</b> 16		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.1604: Projektpraktikum</b> <i>English title: Project Course</i>		6 C 6 SWS
<b>Lernziele/Kompetenzen:</b> Diese Veranstaltung gibt Studierenden die Möglichkeit, grundlegende Schritte eines wissenschaftlichen Projekts kennen zu lernen. In kleinen Gruppen von zwei bis sechs Studierenden werden eigene, überschaubare Versuche zu einem frei wählbaren Thema zunächst konzipiert, aufgebaut und ausgewertet. Die gewonnenen Ergebnisse werden sowohl schriftlich dokumentiert wie auch mündlich präsentiert. Nach erfolgreichem Abschluss des Moduls können die Studierenden komplexe experimentelle Fragestellungen als Projekt in Teamarbeit planen, durchführen, dokumentieren, aus- und bewerten sowie präsentieren.		<b>Arbeitsaufwand:</b> Präsenzzeit: 84 Stunden Selbststudium: 96 Stunden
<b>Lehrveranstaltung: Projektpraktikum (Praktikum)</b>		
<b>Prüfung: Präsentation (ca. 30 Min.; 20 %) und schriftliche Zusammenfassung (max. 30 S.; 80%)</b>		6 C
<b>Prüfungsanforderungen:</b> Planung, Durchführung, Dokumentation und Bewertung von Projekten in Teamarbeit		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> PD Dr. Martin Wenderoth	
<b>Angebotshäufigkeit:</b> jedes Sommersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> 4	
<b>Maximale Studierendenzahl:</b> 200		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phys.1609: Grundlagen zur Einheit von Mensch und Natur</b> <i>English title: Foundations of the Unity of Human and Nature</i>		4 C 2 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten Studierende Einblicke in die naturwissenschaftlichen, ökonomischen und weltanschaulichen Grundlagen der Wechselbeziehung Mensch – Natur gewonnen haben. Sie sollten... <ul style="list-style-type: none"> <li>• über Grundlagen in der Systemdynamik komplexer Systeme verfügen;</li> <li>• mit Präsentationsmedien umgehen können;</li> <li>• komplexe Sachverhalte vor Experten und fachfremden Zuhörern präsentieren können;</li> <li>• den Erkenntnisfortschritt im Seminar kritisch reflektieren können.</li> </ul> Als Schlüsselkompetenzen sollten sie Diskussionsfähigkeit, Kritikfähigkeit und Ausdrucksfähigkeit erworben haben.		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 92 Stunden
<b>Lehrveranstaltung: Grundlagen zur Einheit von Mensch und Natur</b>		
<b>Prüfung: Vortrag (ca. 30 Minuten)</b> <b>Prüfungsvorleistungen:</b> Aktive Mitwirkung an der Diskussion der Präsentationen und Erarbeitung eines laufenden Erkenntnisfortschritts des Seminars als Hausaufgabe <b>Prüfungsanforderungen:</b> Verständnis der wissenschaftlichen Grundlagen der Wechselbeziehung Mensch-Natur anhand wissenschaftlicher Fachliteratur.  Die Entwicklung des Stoffwechsels des Menschen mit der Natur, insbesondere in der Produktion und Reproduktion von Gütern behandelt und ihre philosophische Reflektion wird behandelt. Der Schwerpunkt liegt auf der modernen Entwicklung der internationalen kapitalistischen Produktion zu einem dominanten Einflussfaktor auf die Biosphäre, die daraus resultierenden Möglichkeiten und die Faktoren der möglichen Untergrabung der Einheit von Mensch und Natur in einer globalen Umweltkatastrophe.		4 C
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch, Englisch	<b>Modulverantwortliche[r]:</b> StudiendekanIn der Fakultät für Physik	
<b>Angebotshäufigkeit:</b> jedes Sommersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 4 - 6; Master: 1 - 4	
<b>Maximale Studierendenzahl:</b> nicht begrenzt		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phys.5001: Die Vermittlung und Untersuchung von strömungsphysikalischen Vorgängen im Experiment Teil I</b> <i>English title: Teaching and analysis of flow dynamic processes in physical experiments</i> <i>Part I</i>		6 C 4 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden... <ul style="list-style-type: none"> <li>• die strömungsphysikalischen Grundlagen beherrschen und Messverfahren zur Strömungsvisualisierung an Beispielen anwenden können;</li> <li>• die Strömungsphysikalischen Phänomene anhand von Experimenten vorstellen und erklären können.</li> </ul>		<b>Arbeitsaufwand:</b> Präsenzzeit: 56 Stunden Selbststudium: 124 Stunden
<b>Lehrveranstaltungen:</b> <b>1. Vorlesung</b> (Vorlesung) <b>2. Übung</b>		2 SWS 2 SWS
<b>Prüfung: 80 % mündliche Prüfung (ca. 30 Min.) + 20 % Praktische Prüfung (Experiment) (ca. 30 Min.)</b>		
<b>Prüfungsanforderungen:</b> Auftrieb; Bernoulli-Gleichung; Energiebetrachtung von Strömungsvorgängen; Wirbelablösung; Kontinuitätsgleichung; Wirbelbildung/Entstehung in Abhängigkeit von der Reynoldszahl; Messverfahren zur Visualisierung.		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Dr. rer. nat. Oliver Boguhn	
<b>Angebotshäufigkeit:</b> jedes Sommersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 3 - 6; Master: 1	
<b>Maximale Studierendenzahl:</b> 20		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phys.5002: Die Vermittlung und Untersuchung von strömungsphysikalischen Vorgängen im Experiment Teil II</b> <i>English title: Teaching and analysis of flow dynamic processes in physical experiments Part II</i>		6 C 4 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden... <ul style="list-style-type: none"> <li>• die theoretischen Grundlagen praxisbezogen anwenden und strömungsphysikalische Gesetzmäßigkeiten in Experimenten verifizieren können;</li> <li>• die strömungsphysikalischen Phänomene anhand von Experimenten vorstellen und erklären können.</li> </ul>		<b>Arbeitsaufwand:</b> Präsenzzeit: 56 Stunden Selbststudium: 124 Stunden
<b>Lehrveranstaltungen:</b> <b>1. Vorlesung</b> (Vorlesung) <b>2. Übung</b>		2 SWS 2 SWS
<b>Prüfung: mündliche Prüfung (ca. 30 Min.) + Praktische Prüfung (Experiment) (ca. 30 Min.)</b>		
<b>Prüfungsanforderungen:</b> Wirbelbildung/Entstehung in Abhängigkeit von der Reynoldszahl, Schwingungs- und Flatteranalyse, Schallentstehung, Ausbreitung, Quellen- und Entfernungsabhängigkeiten, Strömungsvorgänge unter Schwerelosigkeit, Strahlungsinduzierte Strömungsvorgänge, Einfluss der Corioliskraft auf großräumige Strömungen		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Dr. rer. nat. Oliver Boguhn	
<b>Angebotshäufigkeit:</b> jedes Wintersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 3 - 6; Master: 1	
<b>Maximale Studierendenzahl:</b> 20		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.5003: Sammlung und Physikalisches Museum</b> <i>English title: Collection and museum of physics</i>		4 C 2 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden eigenständig Inhalte erarbeiten und als Ziel diese Inhalte publikumswirksam im Museum im Rahmen der laufenden Ausstellung präsentieren. Dazu gehört die Darstellung der Funktion, Entwicklungsgeschichte und pädagog. Präsentation eines Gerätes der historischen Sammlung.		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 92 Stunden
<b>Lehrveranstaltung: Seminar</b> (Seminar)		
<b>Prüfung: Hausarbeit (max. 15 S.) und Posterpräsentation</b> <b>Prüfungsvorleistungen:</b> Aktive Teilnahme		
<b>Prüfungsanforderungen:</b> Aufarbeitung und Darstellung eines Gerätes der historischen Sammlung.		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> StudiendekanIn der Fakultät für Physik	
<b>Angebotshäufigkeit:</b> jedes Semester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 6; Master: 1 - 2	
<b>Maximale Studierendenzahl:</b> 8		



<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.5501: Aerodynamik</b> <i>English title: Aerodynamics</i>		6 C 4 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sind die Studierenden mit den physikalischen Grundlagen der Aerodynamik vertraut und sollten diese auf elementare aerodynamische Zusammenhänge anwenden können.		<b>Arbeitsaufwand:</b> Präsenzzeit: 56 Stunden Selbststudium: 124 Stunden
<b>Lehrveranstaltungen:</b> <b>1. Vorlesung Aerodynamik I</b> (Vorlesung) <b>2. Vorlesung Aerodynamik II</b> (Vorlesung)		2 SWS 2 SWS
<b>Prüfung: Klausur (120min.) oder mündliche Prüfung (ca. 30min)</b>		6 C
<b>Prüfungsanforderungen:</b> Kontinuumsphysikalische Grundlagen, Grundgleichungen der reibungsfreien und reibungsbehafteten Strömung, Theorie des Auftriebs, induzierter Widerstand, Kompressibilitäts- und Reibungseffekte und ihre Einordnung über entsprechende Kennzahlen (Machzahl, Reynoldszahl), Grundzüge der Flugmechanik		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. rer. nat. Dr. habil. Andreas Dillmann StudiendekanIn der Fakultät für Physik	
<b>Angebotshäufigkeit:</b> jedes Wintersemester	<b>Dauer:</b> 2 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 5 - 6; Master: 1 - 2	
<b>Maximale Studierendenzahl:</b> 30		
<b>Bemerkungen:</b> Schwerpunkt: AG, BK		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.5502: Aktive Galaxien</b> <i>English title: Active galaxies</i>		3 C 2 SWS
<b>Lernziele/Kompetenzen:</b> Nach dem erfolgreichem Absolvieren des Moduls verfügen die Studierenden Kenntnisse in: <ul style="list-style-type: none"> <li>• Klassifizierung von Aktiven Galaxien,</li> <li>• spektrale Eigenschaften,</li> <li>• Multifrequenzbeobachtungen,</li> <li>• Struktur und Komponenten der Kernregion,</li> <li>• supermassereiche Schwarze Löcher,</li> <li>• thermische und nichtthermische Strahlungsprozesse,</li> <li>• Energieerzeugung</li> </ul>		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 62 Stunden
<b>Lehrveranstaltung: Aktive Galaxien (Vorlesung)</b>		
<b>Prüfung: Mündlich (ca. 30 Minuten)</b> <b>Prüfungsanforderungen:</b> Beherrschen des Stoffs der Vorlesung und der zugehörigen Literatur.		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> Grundvorlesung zur Astronomie	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Wolfram Kollatschny	
<b>Angebotshäufigkeit:</b> jedes Sommersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 4 - 6; Master: 1	
<b>Maximale Studierendenzahl:</b> 40		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5503: Astrophysical Spectroscopy</b>		2 WLH
<b>Learning outcome, core skills:</b> After successful completion of the modul the students should ... <ul style="list-style-type: none"> <li>• know astronomical telescopes and measurement techniques</li> <li>• have an understanding of spectroscopic observation techniques</li> <li>• know principles of spectroscopy and design of astronomical spectrographs</li> <li>• know planning and execution of astronomical observations</li> <li>• data reduction and analysis</li> </ul>		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Lecture</b> (Lecture) <i>Contents:</i> Astrophysical Spectroscopy		
<b>Examination: Written examination (120 Min.) or oral examination (approx. 30 Min.)</b> <b>Examination requirements:</b> Knowledge of astronomical spectroscopy, telescopes, image errors, instrumentation; observation, reduction and analysis of spectroscopic data.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Astrophysics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Ansgar Reiners	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 6; Master: 1 - 2	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b> <b>Module B.Phy.5505: Data Analysis in Astrophysics</b>		3 C 2 WLH
<b>Learning outcome, core skills:</b> After successful completion of the modul students are able to model noise and signal.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Vorlesung</b> (Lecture)		
<b>Examination: Oral examination (approx. 30 minutes)</b>		3 C
<b>Examination requirements:</b> Demonstrate an understanding of concepts developed in lecture: Introduction to methods of data analysis in astrophysics: Random signal and noise; correlation analysis; model fitting by least squares and maximum likelihood; Monte Carlo simulations; Fourier analysis; filtering; signal and image processing; Hilbert transform; mapping; applications to problems of astrophysical relevance.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> StudiendekanIn der Fakultät für Physik	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 6; Master: 1	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.5506: Einführung in die Strömungsmechanik</b> <i>English title: Introduction to fluid dynamics</i>		6 C 4 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden die grundlegenden Begriffe der Strömungsmechanik auf entsprechende Fragestellungen aus den Bereichen der Geo- und Astrophysik bzw. der Biophysik und der Physik komplexer Systeme anwenden können.		<b>Arbeitsaufwand:</b> Präsenzzeit: 56 Stunden Selbststudium: 124 Stunden
<b>Lehrveranstaltung: Vorlesung</b> (Vorlesung)		
<b>Prüfung: Klausur (120 Min.) oder mündliche Prüfung (ca. 30 Min.)</b>		
<b>Prüfungsanforderungen:</b> Theoretische und experimentelle Grundlagen der Strömungsmechanik tropfbarer Flüssigkeiten und Gase: Kontinuumshypothese; Statik, Kinematik und Dynamik von Fluiden; Kontinuitätsgleichung; Bewegungsgleichungen; Dimensionsanalyse; reibungsbehaftete Strömungen, schleichende Strömungen, Grenzschichten, Turbulenz; Potentialströmungen; Wirbelsätze; Impuls- /Impulsmomentengleichungen; Energiegleichung; Stromfadentheorie		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> StudiendekanIn der Fakultät für Physik	
<b>Angebotshäufigkeit:</b> jedes Sommersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 4 - 6; Master: 1 - 3	
<b>Maximale Studierendenzahl:</b> 30		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phys.5507: Elektromagnetische Tiefenforschung</b> <i>English title: Electromagnetic deep sounding</i>		3 C 2 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden die grundlegenden Begriffe der Elektromagnetischen Tiefenforschung kennen und danach gemessene elektromagnetische Daten selbstständig auswerten können.		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 62 Stunden
<b>Lehrveranstaltung: Vorlesung</b> (Vorlesung)		
<b>Prüfung: Klausur (60 Min.) oder mündliche Prüfung (ca. 30 Min.)</b>		
<b>Prüfungsanforderungen:</b> Die wichtigsten Parameter und Algorithmen der Elektromagnetischen Tiefenforschung: Elektromagnetische Induktion, Schätzung der Übertragungsfunktionen und ihrer Vertrauensbereiche, Dimensionalität und Verzerrung, Inversion elektromagnetischer Sondierungskurven, Leitungsmechanismen und Zusammenhänge mit Geodynamik		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Andreas Tilgner	
<b>Angebotshäufigkeit:</b> jedes Wintersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 5 - 6; Master: 1	
<b>Maximale Studierendenzahl:</b> 20		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.5508: Geophysikalische Strömungsmechanik</b> <i>English title: Geophysical fluid mechanics</i>		3 C 2 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden die Bewegungsformen der flüssigen Bestandteile der Erde (Atmosphäre, Ozeane, Kern) oder anderer Planeten kennen und die Thermodynamik, insbesondere der Atmosphäre, verstehen.		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 62 Stunden
<b>Lehrveranstaltung: Vorlesung</b> (Vorlesung)		
<b>Prüfung: mündliche Prüfung (ca. 30 Min.) oder Klausur (30 Min.)</b>		
<b>Prüfungsanforderungen:</b> Aufbau der Erdatmosphäre, adiabatischer Gradient und Temperaturschichtung, Corioliskraft und Besonderheiten rotierender Strömungen (geostrophisches Gleichgewicht, Inertial- und Rossbywellen, Ekman-schichten), Strahlungshaushalt, globale Zirkulation der Atmosphäre und Ozeane, Wettersysteme der mittleren Breiten, Schwerewellen, Konvektion, Instabilität und Turbulenz.		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Andreas Tilgner	
<b>Angebotshäufigkeit:</b> unregelmäßig	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 4 - 6; Master: 1 - 3	
<b>Maximale Studierendenzahl:</b> nicht begrenzt		
<b>Bemerkungen:</b> Schwerpunkt Astro-/Geophysik		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5511: Magnetohydrodynamics</b>		2 WLH
<b>Learning outcome, core skills:</b> After successful completion of this module, students should be able to apply the fundamental concepts and methods of magnetohydrodynamics to geo- and astrophysical problems.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Lecture</b> (Lecture)		
<b>Examination: Written examination (120 Min.) or oral examination (approx. 30 Min.)</b> <b>Examination requirements:</b> Demonstrate an understanding of the most important subjects treated during the lecture: The induction equation, the dynamo effect, mean field magnetohydrodynamics, Alfvén-waves		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Andreas Tilgner	
<b>Course frequency:</b> every 4th semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 20		



<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5512: Low-mass stars, brown dwarfs, and planets</b>		2 WLH
<b>Learning outcome, core skills:</b> After successful completion of the modul students should be familiar with concepts of stellar and planetary astrophysics and should know how to applicate physical concepts in an astrophysical context.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Lecture</b> (Lecture)		
<b>Examination: Written examination (120 Min.) or oral examination (approx. 30 Min.)</b>		3 C
<b>Examination requirements:</b> Formation, evolution, structure, and atmospheres of low-mass stars and sub-stellar objects; detection and characterization methods		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to astrophysics.	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Stefan Dreizler	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 6; Master: 1 - 3	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module B.Phy.5513: Numerical fluid dynamics</b>		4 WLH
<b>Learning outcome, core skills:</b> After completion of this module students should ... <ul style="list-style-type: none"> <li>• know the basic methods for solving partial differential equations</li> <li>• be able to program and analyze numerical methods for the solution of partial differential equations.</li> </ul>		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Lecture with exercises</b>		
<b>Examination: Written report (max. 15 S.) or oral examination (approx. 30 Min.)</b> <b>Examination requirements:</b> Basic programming skills. Finite difference, finite volume, finite element and spectral methods. Explicit and implicit time steps. Stability analysis.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Andreas Tilgner	
<b>Course frequency:</b> every 4th semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b>		3 C 2 WLH
<b>Module B.Phy.5514: Physics of the Interior of the Sun and Stars</b>		
<b>Learning outcome, core skills:</b> After successful completion of the modul students should be able ... <ul style="list-style-type: none"> <li>• to understand the equations of stellar structure,</li> <li>• to understand current questions about the physics of solar/stellar interiors and magnetism,</li> <li>• to understand the physics of solar/stellar oscillations and their diagnostic potential.</li> </ul>		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Vorlesung</b> (Lecture)		
<b>Examination: Oral examination (approx. 30 minutes)</b>		3 C
<b>Examination requirements:</b> Demonstrate an understanding of concepts developed in lecture: Introduction to stellar structure, evolution, and dynamics; rotation; convection; dynamos; observations of solar and stellar oscillations; introduction to stellar pulsations; normal modes; weak perturbation theory; numerical forward modeling		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> StudiendekanIn der Fakultät für Physik	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 3	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phys.5516: Physik der Galaxien</b> <i>English title: Physics of Galaxies</i>		3 C 2 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls verfügen die Studierenden über Kenntnisse zu folgenden Schwerpunkten: <ul style="list-style-type: none"> <li>• Klassifizierung von Galaxien,</li> <li>• Helligkeitsprofile,</li> <li>• spektroskopische Eigenschaften,</li> <li>• stellare Population und interstellares Medium,</li> <li>• Kinematik,</li> <li>• Massen(bestimmungsmethoden),</li> <li>• Galaxienentwicklung</li> </ul>		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 62 Stunden
<b>Lehrveranstaltung: Vorlesung</b> (Vorlesung)		
<b>Prüfung: Mündlich (ca. 30 Minuten)</b> <b>Prüfungsanforderungen:</b> <ul style="list-style-type: none"> <li>• morphologische Galaxienklassifikation,</li> <li>• Oberflächenhelligkeit,</li> <li>• Aufbau und Struktur von Galaxien,</li> <li>• Rotation und Dynamik,</li> <li>• stellare Zusammensetzung und Gaskomponenten des Interstellaren Mediums,</li> <li>• Galaxienmassen,</li> <li>• Skalierungsrelationen,</li> <li>• Galaxienentwicklung</li> </ul>		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Wolfram Kollatschny	
<b>Angebotshäufigkeit:</b> jedes Wintersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 4 - 6; Master: 1	
<b>Maximale Studierendenzahl:</b> 40		

<b>Georg-August-Universität Göttingen</b> <b>Module B.Phy.5517: Physics of the Sun, Heliosphere and Space Weather: Key Knowledge</b>		3 C 2 WLH
<b>Learning outcome, core skills:</b> After successful completion of the module the participants understand: <ul style="list-style-type: none"> <li>• the elementary parameters of the Sun-Earth-System,</li> <li>• the origin and different forms of solar activity,</li> <li>• the physical processes of the heliosphere,</li> <li>• the exploration of space and the Sun with space missions,</li> <li>• the effects of the Sun on Earth and space weather.</li> </ul>		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Physics of the Sun, Heliosphere and Space Weather: Key Knowledge</b> (Lecture) <i>Contents:</i> <ul style="list-style-type: none"> <li>• Basic knowledge of the Sun-Earth-System,</li> <li>• Basic physics of the Sun, its outer atmosphere and its effects on interplanetary spac,</li> <li>• Exploration of the Sun and space with dedicated spacecraft and instruments,</li> <li>• Effects of the Sun on Earth, including cosmic effects,</li> </ul> Finally, the research field of space weather, different forecast methods and new projects will be presented.		
<b>Examination: Written examination (120 Min.) or oral examination (approx. 30 Min.)</b> <b>Examination requirements:</b> Knowledge of the causes of solar activity, its different forms and physical processes. Basics knowledge of the solar corona and its effects on interplanetary space and Earth. Operation of spacecraft and instruments for exploration of the Sun and heliosphere. Knowledge about the physical processes of the terrestrial magnetosphere and ionosphere, and space weather, including the fundamental methods of forecast models.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Ansgar Reiners Contact Person: Dr. Bothmer	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 4 - 6; Master: 1	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b>		3 C 2 WLH
<b>Module B.Phy.5518: Physics of the Sun, Heliosphere and Space Weather: Space Weather Applications</b>		
<b>Learning outcome, core skills:</b> Learning outcome: Introduction into the physics processes of space weather based on applied study cases.  Core skills: Knowledge about physical processes of space weather and its applications. Ability in self-organised solving of case studies.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Vorlesung</b> (Lecture)		
<b>Examination: Oral examination (approx. 30 Min.) or written examination (120 Min.)</b> <b>Examination requirements:</b> Knowledge about physical processes of space weather.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Ansgar Reiners Contact person: Dr. Bothmer	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 4 - 6; Master: 1	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.5519: Plattentektonik und Geophysikalische Exploration</b> <i>English title: Plate tectonics and geophysical exploration</i>		3 C 2 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden ... <ul style="list-style-type: none"> <li>• die Entstehung der modernen Theorie der Plattentektonik nachvollziehen können</li> <li>• die wichtigsten Beiträge der verschiedenen Explorationsverfahren zur Rekonstruktion der Plattenbewegungen kennen.</li> </ul>	<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 62 Stunden	
<b>Lehrveranstaltung: Vorlesung</b> (Vorlesung)		
<b>Prüfung: Klausur (60 Min.) oder mündliche Prüfung (ca. 30 Min.)</b>		
<b>Prüfungsanforderungen:</b> Die wichtigsten Beiträge der verschiedenen Explorationsverfahren zur Rekonstruktion der Plattenbewegungen; die drei verschiedenen Moden der Plattentektonik.  Kontinentalverschiebungstheorie; Paläomagnetismus; Konduktion und Konvektion; Plattentektonik; Subduktion; Erdbeben; Seismologie; Anisotropie; Lattice-preferred Orientation.		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> StudiendekanIn der Fakultät für Physik	
<b>Angebotshäufigkeit:</b> jedes Wintersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 5 - 6; Master: 1 - 3	
<b>Maximale Studierendenzahl:</b> 20		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.5521: Seminar zu einem Thema der Geophysik</b> <i>English title: Seminar on Geophysics</i>		4 C 2 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten Studierende sich selbstständig in eine Fragestellung aus der Geophysik und Ihrem fachlichen Umfeld einarbeiten und einen Vortrag mit schriftlicher Zusammenfassung erarbeiten können.		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 92 Stunden
<b>Lehrveranstaltung: Seminar</b> (Seminar)		
<b>Prüfung: Vortrag (ca. 60 Min.) mit schriftlicher Ausarbeitung (max. 20 S)</b> <b>Prüfungsvorleistungen:</b> Aktive Teilnahme		
<b>Prüfungsanforderungen:</b> Selbständige Einarbeitung in ein Thema der Geophysik, Vorbereitung eines für Bachelor-Studenten verständlichen Vortrages mit schriftlicher Zusammenfassung.		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Andreas Tilgner	
<b>Angebotshäufigkeit:</b> unregelmäßig	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 4 - 6; Master: 1 - 3	
<b>Maximale Studierendenzahl:</b> 20		
<b>Bemerkungen:</b> Schwerpunkt Astro-/Geophysik		



<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5522: Solar Eclipses and Physics of the Corona</b>		2 WLH
<b>Learning outcome, core skills:</b> After successfully completed the modul students should understand the basic processes on how a cool star can heat and sustain its million Kelvin hot outer atmosphere, the corona. Using basic concepts of magnetohydrodynamics they should also be able to explain the structure and dynamics of the corona.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Lecture</b> (Lecture)		
<b>Examination: Written examination (120 Min.) or oral examination (approx. 30 Min.)</b> <b>Examination requirements:</b> Understanding of basic physical process in the corona of a star. The exam will be based on exercises distributed during the lecture course.  Phenomenology of solar eclipses, timing of eclipses; Physics of hot gases; interaction of gas and magnetic field in the outer atmosphere of the Sun and other stars; physical processes for plasma heating („coronal heating“); wave and Ohmic heating, acceleration of plasma to form a solar wind, solar-terrestrial relations		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> -Introduction to astrophysics - Electrodynamics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> apl. Prof. Dr. Hardi Peter	
<b>Course frequency:</b> every 4th semester; summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 4 - 6; Master: 1 - 3	
<b>Maximum number of students:</b> not limited		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module B.Phy.5523: General Relativity</b>		6 WLH
<b>Learning outcome, core skills:</b> The students master the foundations of General Relativity mathematically and physically. They are able to perform corresponding computations in simple models.		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Courses:</b> <b>1. General Relativity</b> (Lecture)		4 WLH
<b>2. Exercises</b>		2 WLH
<b>Examination: Written examination (120 minutes)</b> <b>Examination requirements:</b> Basic structures of Differential geometry, simple examples of computations, Einstein's equation, underlying principles, Schwarzschild space-time, classical tests of General Relativity, foundations of cosmology.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basic knowledge of Mechanics, Electrodynamics and special Relativity, Analysis of several real variables	
<b>Language:</b> German, English	<b>Person responsible for module:</b> apl. Prof. Folkert Müller-Hoissen	
<b>Course frequency:</b> Two-year as required / Winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 60		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5531: Origin of solar systems</b>		2 WLH
<b>Learning outcome, core skills:</b> After finishing the module the students should be able to apply the fundamental knowledge about the structure and the formation of planetary systems to geophysical and astrophysical problems.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Lecture</b> (Lecture)		
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> Theory and observation of early phases of stars and planetary systems, including extrasolar planets and our own solar system.  In particular: Early phases of formation of stars and protoplanetary disks, models of the condensation of molecules and minerals during formation of planetary systems, chemistry and radiation in low-density astrophysical environments, formation of planets and their migration, small solar system bodies as source of information on the early solar system.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Astrophysics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Stefan Dreizler Ansprechpartner: Dr. Jockers, Dr. Krüger	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> from 4	
<b>Maximum number of students:</b> not limited		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phys.5532: Symmetrien und Nichtlineare Differenzialgleichungen in der Physik</b> <i>English title: Symmetries and Nonlinear Differential Equations in Physics</i>		6 C 6 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten Studierende... <ul style="list-style-type: none"> <li>• ein Verständnis verschiedener Symmetriebegriffe in Zusammenhang mit gewöhnlichen und partiellen Differenzialgleichungen, insbesondere Lie-Punktsymmetrien und Berührungstransformationen, aber auch allgemeine Koordinatentransformationen und Eichtransformationen, sowie deren Relevanz in physikalischen Theorien gewonnen haben;</li> <li>• die Anwendungsfähigkeit auf relevante Beispiele aus der Physik entwickelt haben;</li> <li>• die wichtigsten Solitonengleichungen, Lösungsmethoden, Eigenschaften exakter Lösungen, Auftreten in physikalischen Modellen kennen.</li> <li>• einen Überblick gewinnen hinsichtlich der Bedeutung von kontinuierlichen Symmetrien für die Untersuchung von Differenzialgleichungen und als Grundlage physikalischer Theorien;</li> <li>• in der Lage sein, grundlegende mathematische Methoden auf einfache Beispiele anwenden zu können;</li> <li>• das Auftreten von Solitonen (lokalisierte und formstabile Wellen mit einer Art nichtlinearem Superpositionsprinzip) als typisch nichtlineares Phänomen (spezieller) nichtlinearer partieller Differenzialgleichungen verstanden haben;</li> <li>• die Fähigkeit zur Nutzung von Mathematiksoftware (Mathematica oder Maple) in diesem Kontext entwickelt haben.</li> </ul>		<b>Arbeitsaufwand:</b> Präsenzzeit: 84 Stunden Selbststudium: 96 Stunden
<b>Lehrveranstaltungen:</b> <b>1. Symmetrien und Nichtlineare Differenzialgleichungen in der Physik</b> (Vorlesung) <b>2. Symmetrien und Nichtlineare Differenzialgleichungen in der Physik</b> (Übung)		4 SWS 2 SWS
<b>Prüfung: Klausur (120Min.) oder mdl. Prüfung (ca. 30 Min.)</b> <b>Prüfungsanforderungen:</b> Symmetriebegriffe, Anwendungsfähigkeit entsprechender Methoden in einfachen Beispielen; spezielle mathematische Methoden der Theorie integrierbarer Systeme; Beispiele von Solitonen-Gleichungen und deren Auftreten in physikalischen Systemen.		6 C
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> Differenzial- und Integralrechnung mehrerer Veränderlicher; Grundlagen der komplexen Analysis; Grundkenntnisse der Mechanik und Elektrodynamik	
<b>Sprache:</b> Deutsch, Englisch	<b>Modulverantwortliche[r]:</b> apl. Prof. Folkert Müller-Hoissen	
<b>Angebotshäufigkeit:</b> alle zwei Jahre im WiSe	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b>	<b>Empfohlenes Fachsemester:</b>	

dreimalig	ab 4
<b>Maximale Studierendenzahl:</b> nicht begrenzt	
<b>Bemerkungen:</b> Bachelor und Master Schwerpunkt Astro-/Geophysik, Biophysik/Komplexe Systeme; Kern-/Teilchenphysik	

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module B.Phy.5533: Solar and Stellar Activity</b>		
<b>Learning outcome, core skills:</b> Fundamental knowledge of solar and stellar structure, sun-like stars, generation of magnetic fields and magnetic activity, physics of the chromosphere and corona, dynamo mechanisms, evolution of stellar activity and other stellar parameters, star-planet interaction.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Lecture</b> (Lecture)		
<b>Examination: Written examination (ca. 120 Min.) or oral examination (approx. 30 Min.)</b> <b>Examination requirements:</b> Knowledge of the structure of the sun and solar-like stars; generation of magnetic fields and magnetic activity; physics of the chromosphere and the corona; dynamo mechanisms; evolution of stellar activity; star-planet interaction		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Astrophysics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Ansgar Reiners	
<b>Course frequency:</b> unregular	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 6; Master: 1 - 4	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module B.Phy.5538: Stellar Atmospheres</b>		4 WLH
<b>Learning outcome, core skills:</b> After successful completion of the modul students should know how to applicate physical concepts (such as atomic and molecular physics, thermodynamics, and statistical physics) in an astrophysical context, and know their implementation in numerical simulations.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Courses:</b>		
<b>1. Physics of stellar atmospheres (Vorlesung)</b>		2 WLH
<b>2. Stellar atmosphere modelling (Computerpraktikum)</b>		2 WLH
<b>Examination: Oral Exam (ca. 30 Min.)</b>		6 C
<b>Examination requirements:</b> Oral account of the context and concepts learned during the two courses on the topics of interaction of radiation and matter; radiative transfer; structure of stellar atmospheres; and theoretical foundations of spectral analysis; answering of specific questions on all the aspects in this field.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Stefan Dreizler	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 20		
<b>Additional notes and regulations:</b> Schwerpunkt: Astro-/Geophysik		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5539: Physics of Stellar Atmospheres</b>		2 WLH
<b>Learning outcome, core skills:</b> After successful completion of the modul students should understand the interaction of radiation and matter, radiative transfer, structure of stellar atmospheres; thorough understand the theoretical foundations of spectral analysis and know how to applicate physical concepts (such as atomic and molecular physics, thermodynamics, and statistical physics) in an astrophysical context.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Physics of stellar atmospheres (Vorlesung)</b>		
<b>Examination: Oral Exam (ca. 30 Min.)</b>		3 C
<b>Examination requirements:</b> Oral account of the context and concepts of radiative transfer and structure of stellar atmospheres.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Stefan Dreizler	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 20		
<b>Additional notes and regulations:</b> Schwerpunkt: Astro-/Geophysik		



<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5540: Introduction to Cosmology</b>		2 WLH
<b>Learning outcome, core skills:</b> After successful completion of the modul students should understand the evolution of the universe on very large scales, knowledge of current questions in physical cosmology.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Lecture Introduction to Cosmology</b>		
<b>Examination: written (120 min.) or oral (ca. 30 min.) exam</b> <b>Examination requirements:</b> Key concepts and calculations from homogeneous cosmology: Newtonian cosmology; relativistic homogeneous isotropic cosmology; horizons and distances; the hot universe; Newtonian inhomogeneous cosmology; inflation.  This course will be based on video lectures and short quizzes that will be discussed in class.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Jens Niemeyer	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 4 - 6; Master: 1 - 3	
<b>Maximum number of students:</b> 20		
<b>Additional notes and regulations:</b> Schwerpunkt: Astro-/Geophysik; Kern-/Teilchenphysik		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5543: Black Holes</b>		2 WLH
<b>Learning outcome, core skills:</b> After successfully completing the module, students are expected to understand the basic mathematical properties of black holes as solutions of Einstein's equations of General Relativity and to know the scenarios of astrophysical black hole formation.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Black Holes</b> (Lecture)		
<b>Examination: Written examination (120 Min.) or oral examination (approx. 30 Min.)</b>		3 C
<b>Examination requirements:</b> Gravitational collapse, Schwarzschild black holes, charged black holes, rotating black holes, horizon properties, black hole mechanics, black hole thermodynamics		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basic knowledge of General Relativity	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Jens Niemeyer	
<b>Course frequency:</b> at irregular intervals	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 6; Master: 1 - 4	
<b>Maximum number of students:</b> not limited		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5544: Introduction to Turbulence</b>		2 WLH
<p><b>Learning outcome, core skills:</b></p> <p><b>Learning objectives:</b> In this course, the students will be introduced to the phenomenon of turbulence as a complex system that can be treated with methods from non-equilibrium statistical mechanics. The necessary statistical tools will be introduced and applied to obtain classical and recent results from turbulence theory. Furthermore, current numerical and experimental techniques will be discussed.</p> <p><b>Competencies:</b> The students shall gain a fundamental understanding of turbulent flows as a problem of non-equilibrium statistical mechanics. Part of the course will be held in tutorial style in which textbook problems will be discussed in detail. The course shall also strengthen the students' ability to perform interdisciplinary work by stressing the interdisciplinary aspects of the field with connections to pure and applied math as well as engineering sciences.</p>		<p><b>Workload:</b></p> <p>Attendance time: 28 h</p> <p>Self-study time: 62 h</p>
<b>Course: Introduction to Turbulence (Lecture)</b>		
<p><b>Examination: Written exam (90 min.) or oral exam (approx. 30 min.)</b></p> <p><b>Examination requirements:</b></p> <p>Basic knowledge and understanding of the material covered in the course such as: continuum description of fluids (Navier-Stokes equations), non-dimensionalization &amp; dimensional analysis, Kolmogorov phenomenology, intermittency, exact statistical approaches &amp; the closure problem, soluble models of turbulence.</p>		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basic Knowledge in continuum mechanics or electrodynamics	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Eberhard Bodenschatz	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 25		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.5545: Angewandte Geophysik</b> <i>English title: Applied Geophysics</i>		3 C 3 SWS
<b>Lernziele/Kompetenzen:</b> <b>Lernziele:</b> Chancen und Risiken bei der Suche nach Bodenschätzen, die wichtigsten Verfahren der angewandten Geophysik  <b>Kompetenzen:</b> <ol style="list-style-type: none"> <li>1. Die wichtigsten Verfahren der angewandten Geophysik: Gravimetrie, Seismik, Magnetotellurik, Geoelektrik, Bodenradar, Magnetik</li> <li>2. Fossile Energieträger und ihr Beitrag zum Treibhauseffekt; sinnvolle und gefährlich Geoengineering-Techniken zur Reduktion des Treibhauseffektes</li> <li>3. Wechselwirkungen zwischen wirtschaftlichen Interessen, Umweltinteressen und der Exploration nach Bodenschätzen</li> </ol>		<b>Arbeitsaufwand:</b> Präsenzzeit: 42 Stunden Selbststudium: 48 Stunden
<b>Lehrveranstaltungen:</b> <b>1. Angewandte Geophysik</b> (Vorlesung) <b>2. Angewandte Geophysik</b> (Exkursion) <i>Inhalte:</i> Exkursion nach Schottland oder einer anderen Lokation mit erheblichem Potenzial für erneuerbare Energien, z.B. Gezeitenkraftwerke oder geothermische Exploration		
<b>Prüfung: Klausur oder mündliche Prüfung, Klausur (60 Min.) oder mündliche Prüfung (ca. 30 Min.)</b>		3 C
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Karsten Bahr	
<b>Angebotshäufigkeit:</b> jedes Sommersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 4 - 6; Master: 1 - 2	
<b>Maximale Studierendenzahl:</b> 20		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phys.5601: Theoretical and Computational Neuroscience I</b> <i>English title: Theoretical and Computational Neuroscience I</i>		3 C 2 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden... <ul style="list-style-type: none"> <li>• ein vertieftes Verständnis folgender Themen entwickelt haben: TCN I: biophysikalische Grundlagen neuronaler Anregbarkeit, mathematische Grundlagen neuronaler Anregbarkeit, Input-Output Beziehungen und Bifurkationen, Klassifizierung, Existenz, Stabilität und Koexistenz synchroner und asynchroner Zustände in spikenden neuronalen Netzwerken;</li> <li>• Methoden und Methodenentwicklung für die Analyse hochdimensionaler Modelle ratenkodierter Einheiten in Feldmodellen verstehen;</li> <li>• die Handhabung von Bifurkationsszenarien und zugehörigen Instabilitäten verstanden haben.</li> </ul>		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 62 Stunden
<b>Lehrveranstaltung: Collective Dynamics Biological Neural Networks I</b> (Vorlesung)		
<b>Prüfung: Klausur (120 Min.) oder mündl. Prüfung (ca. 30 Min.) oder Vortrag (ca. 30 Min., 2 Wochen Vorbereitungszeit).</b>		3 C
<b>Prüfungsanforderungen:</b> Grundlagen der Membranbiophysik; Bifurkationen anregbarer Systeme; Verständnis der Grundlagen der Modellierungsansätze der Neurophysik; kollektive Zustände spikender neuronaler Netzwerke; insbesondere Synchronizität; Balanced State; Phase-Locking und diesen Zuständen unterliegenden lokalen und Netzwerkeigenschaften: Netzwerktopologie; Delays; inhibitorische und exzitatorische Kopplung; sparse random networks		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Englisch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Fred Wolf	
<b>Angebotshäufigkeit:</b> jedes Wintersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 4 - 6; Master: 1	
<b>Maximale Studierendenzahl:</b> 90		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phys.5602: Theoretical and Computational Neuroscience II</b> <i>English title: Theoretical and Computational Neuroscience II</i>		3 C 2 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten Studierende... <ul style="list-style-type: none"> <li>das vertiefte Verständnis folgender Themen entwickelt haben: TCN II: Grundlagen neuronaler Anregbarkeit, Input-Output Beziehungen bei Einzelneuronen, eindimensionale Feldmodelle (Feature Selectivity, Contrastinvariance), zweidimensionale Feldmodell (Zusammenwirken von kurz- und langreichweitigen Verbindungen sowie lokaler Nichtlinearitäten), Amplitudengleichungen und ihre Lösungen;</li> <li>Methoden und Methodenentwicklung für die Analyse spikender neuronaler Netzwerke mit und ohne Delays, Handhabung von Bifurkationsszenarien und zugehörigen Instabilitäten verstehen.</li> </ul>		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 62 Stunden
<b>Lehrveranstaltung: Collective Dynamics Biological Neural Networks II</b> (Vorlesung)		
<b>Prüfung: Klausur (120 Min.) oder mündl. Prüfung (ca. 30 Min.) oder Vortrag (ca. 30 Min., 2 Wochen Vorbereitungszeit).</b>		3 C
<b>Prüfungsanforderungen:</b> Ratenmodelle von Einzelneuronen; Feldansatz in der theoretischen Neurophysik; Grundlagen der Bifurkationen anregbarer System; Verständnis der Grundlagen der Modellierungsansätze der Neurophysik; Zusammenhang diskrete/kontinuierliche Modelle; kollektive Zustände ein- und zweidimensionaler Feldmodelle, insbesondere ring model of feature selectivity; orientation preference maps.		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Englisch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Fred Wolf	
<b>Angebotshäufigkeit:</b> jedes Sommersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 4 - 6; Master: 1	
<b>Maximale Studierendenzahl:</b> 90		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.5603: Einführung in die Laserphysik</b> <i>English title: Introduction to laserphysics</i>		3 C 2 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls verfügen die Studierenden über folgende Grundkenntnisse: <ul style="list-style-type: none"> <li>• Die dem Laser zugrundeliegenden Prinzipien.</li> <li>• Die Beschreibung des Laserprozesses durch Ratengleichungen sowie stationäre und zeitabhängige Lösungen derselben.</li> <li>• Stabilität von Laserresonatoren sowie Eigenschaften der aus Ihnen emittierten Strahlung.</li> <li>• Aufbau und Eigenschaften unterschiedlicher Lasertypen.</li> <li>• Ausgewählte Laserprobleme (Linienbreite, Hole Burning, Kurze Pulse, ...)</li> </ul>		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 62 Stunden
<b>Lehrveranstaltung: Vorlesung</b> <i>Inhalte:</i> Das Prinzip des Lasers wird aufbauend auf einfachen Grundbegriffen entwickelt, dabei aber keineswegs auf quantitative Aussagen verzichtet. Im Mittelpunkt stehen die Analyse des stationären und zeitabhängigen Verhaltens von Lasern mit Hilfe des Ratengleichungsmodelles sowie die Diskussion optischer Resonatoren. Weiterhin werden die physikalischen Grundideen am Beispiel der wichtigsten Lasertypen herausgearbeitet. Eine einführende Behandlung einiger ausgewählter Probleme (Linienbreite, Hole Burning, Kurze Pulse, ...) rundet die Vorlesung ab.		
<b>Prüfung: Mündlich (ca. 30 Minuten)</b> <b>Prüfungsanforderungen:</b> Laserprinzip; Ratengleichungen; Funktionsweise von Lasern (Festkörper, Farbstoff, Gas, Halbleiter und Freier-Elektronen); Wellengleichung; strahlen- und wellenoptische Behandlung von Resonatoren. Entwicklung des Laserprinzips aus einfachen Grundbegriffen: Licht und Materie, Laserprinzip, Ratengleichungen, Lasertypen, optische Resonatoren, ausgewählte Themen.		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> PD Dr. rer. nat. Alexander Egner	
<b>Angebotshäufigkeit:</b> jedes Wintersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 6; Master: 1 - 4	
<b>Maximale Studierendenzahl:</b> 20		

<b>Georg-August-Universität Göttingen</b>		3 C 2 WLH
<b>Module B.Phy.5604: Foundations of Nonequilibrium Statistical Physics</b>		
<b>Learning outcome, core skills:</b> <b>Lernziele:</b> Invariant densities of phase-space flows with local and global conservation of phase-space volume; reduction of a microscopic dynamics to a stochastic description, to kinetic theory and to hydrodynamic transport equations; fluctuation theorems; Green-Kubo relations; local equilibrium; entropy balance and entropy production; the second law; statistical physics of equilibrium processes as a limit of a non-equilibrium processes; applications in nanotechnology and biology: small systems far from thermodynamic equilibrium.  <b>Kompetenzen:</b> After successful completion of the modul the students should know modeling approaches for a statistical-physics description of small systems far from thermodynamic equilibrium: in homework problems, that will be presented in a subsequent symposium, this will be highlighted by explicitly working out examples in nanotechnology and biology.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: lecture</b>		
<b>Examination: Presentation (approx. 30 min) and handout (max. 4 pages)</b>		3 C
<b>Examination requirements:</b> Modeling of an experimental system by a Master equation, kinetic theory or Non-Equilibrium Molecular Dynamics with discussion of the appropriate fluctuation relations and/or the relation of models on different levels of coarse graining.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Statistische Physik	
<b>Language:</b> English	<b>Person responsible for module:</b> StudiendekanIn der Fakultät für Physik	
<b>Course frequency:</b> unregelmäßig	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 4 - 6; Master: 1	
<b>Maximum number of students:</b> 20		



<b>Georg-August-Universität Göttingen</b> <b>Module B.Phy.5605: Computational Neuroscience: Basics</b>		3 C 2 WLH
<b>Learning outcome, core skills:</b> <b>Goals:</b> Introduction to the different fields of Computational Neuroscience: <ul style="list-style-type: none"> <li>• Models of single neurons,</li> <li>• Small networks,</li> <li>• Implementation of all simple as well as more complex numerical computations with few neurons.</li> <li>• Aspects of sensory signal processing (neurons as ,filters'),</li> <li>• Development of topographic maps of sensory modalities (e.g. visual, auditory) in the brain,</li> <li>• First models of brain development,</li> <li>• Basics of adaptivity and learning,</li> <li>• Basic models of cognitive processing.</li> </ul> <b>Kompetenzen/Competences:</b> On completion the students will have gained... <ul style="list-style-type: none"> <li>• ... overview over the different sub-fields of Computational Neuroscience;</li> <li>• ... first insights and comprehension of the complexity of brain function ranging across all sub-fields;</li> <li>• ... knowledge of the interrelations between mathematical/modelling methods and the to-be-modelled substrate (synapse, neuron, network, etc.);</li> <li>• ... access to the different possible model level in Computational Neuroscience.</li> </ul>		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Computational Neuroscience: Basics (Lecture)</b>		
<b>Examination: Written examination (45 minutes)</b> <b>Examination requirements:</b> Actual examination requirements: Having gained overview across the different sub-fields of Computational Neuroscience; Having acquired first insights into the complexity of across the whole bandwidth of brain function; Having learned the interrelations between mathematical/modelling methods and the to-be-modelled substrate (synapse, neuron, network, etc.) Being able to realize different level of modelling in Computational Neuroscience.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Florentin Andreas Wörgötter	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> Bachelor: 2 - 6; Master: 1 - 4	

<b>Georg-August-Universität Göttingen</b>		4 C 2 WLH
<b>Module B.Phy.5607: Seminar: Mechanics and dynamics of the cytoskeleton</b>		
<b>Learning outcome, core skills:</b> After successfully finishing this course, students will be able to work on specific questions with the help of book chapters or journal publications and to present the topic in a seminar talk.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Seminar: Mechanics and dynamics of the cytoskeleton</b>		
<b>Examination: Presentation with discussion (Bachelor approx. 30 min., Master approx. 60 min.)</b> <b>Examination prerequisites:</b> Active participation <b>Examination requirements:</b> Polymer physics and polymer networks; membranes; physics on small scales; cell mechanics; molecular motors; cell motility; dynamics in the cell.		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Biophysics and/or Physics of Complex Systems	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Sarah Köster	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 14		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5608: Micro- and Nanofluidics</b>		2 WLH
<b>Learning outcome, core skills:</b> After successfully finishing this course, students will be familiar with basic hydrodynamics and their applications in biology, biophysics, material sciences and biotechnology. They should know the fundamentals of fluid dynamics on small scales and be able to apply them independently to specific questions.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Lecture</b>		
<b>Examination: Oral exam (ca. 30 min.) or written exam (60 min.)</b> <b>Examination requirements:</b> Fluid dynamics, hydrodynamics on the micro- and nanoscale and its applications in biology, biophysics, material sciences and biotechnology; wetting and capillarity; "life" at low Reynolds numbers; soft lithography; fluidics in biology and biophysics, "lab-on-a-chip" applications; Navier-Stokes-Equation		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Biophysics and/or Physics of Complex Systems	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Sarah Köster	
<b>Course frequency:</b> every 4th semester; summerterm, in even years	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> not limited		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5611: Optical spectroscopy and microscopy</b>		2 WLH
<b>Learning outcome, core skills:</b> <b>Learning outcome:</b> Physical basics of fluorescence and fluorescence spectroscopy, fluorescence anisotropy, fluorescence lifetime, fluorescence correlation spectroscopy, basics of optical microscopy, resolution limit of optical microscopy, wide field and confocal microscopy, super-resolution microscopy. <b>Core skills:</b> The students shall learn the basics and applications of advanced fluorescence spectroscopy and microscopy, including single-molecule spectroscopy and all variants of super-resolution fluorescence microscopy.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Lecture</b>		
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> Fundamental understanding of the physics of fluorescence and the applications of fluorescence in spectroscopy and microscopy.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> StudiendekanIn der Fakultät für Physik	
<b>Course frequency:</b> every 4th semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 4 - 6; Master: 1	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5613: Soft Matter Physics</b>		2 WLH
<b>Learning outcome, core skills:</b> After successfully finishing this course, students will be familiar with fundamental concepts of soft condensed matter physics and will be able to apply them independently to specific questions.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Soft Matter Physics (Lecture)</b>		3 WLH
<b>Examination: Written exam (120 min.) or oral exam (ca. 30 min.)</b> <b>Examination requirements:</b> Intermolecular interactions; phase transitions; interface physics; amphiphilic molecules; colloids; polymers; polymer networks; gels; fluid dynamics; self-organization.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to...Biophysics or/and Physics of complex systems or/and Solid State Physics or/and Materials Physics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Sarah Köster	
<b>Course frequency:</b> every 4th semester; summerterm, in odd years	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> not limited		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module B.Phy.5614: Proseminar Computational Neuroscience</b>		2 WLH
<b>Learning outcome, core skills:</b> After successful completion of the module, students have deepened their knowledge in computational neuroscience / neuroinformatics by independent preparation of a topic. They should... - know and be able to apply methods of presentation of topics from computer science; - be able to deal with (English-language) literature; - be able to present a topic of computer science; - be able to lead a scientific discussion.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Proseminar</b>		
<b>Examination: Talk (approx. 45 Min.) with written report (max. 7 S.)</b> <b>Examination requirements:</b> Proof of the acquired knowledge and skills to deal with scientific literature from the field of computational neuroscience / neuroinformatics under guidance by presentation and preparation.		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> B.Phy.5605	
<b>Language:</b> English	<b>Person responsible for module:</b> StudiendekanIn der Fakultät für Physik	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 4 - 6; Master: 1 - 3	
<b>Maximum number of students:</b> 14		

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module B.Phy.5616: Biophysics of the cell - physics on small scales</b>		
<b>Learning outcome, core skills:</b> After successfully finishing this course, students will be familiar with fundamental concepts of cellular biophysics and will be able to apply them independently to specific questions.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Courses:</b> <b>1. Lecture</b> (Lecture) <b>2. Homework/Excercises</b>		3 WLH 1 WLH
<b>Examination: Written exam (120 min.) or oral exam (ca. 30 min.)</b> <b>Examination prerequisites:</b> 50% of homework/problem sets have to be solved <b>Examination requirements:</b> Physical principles in cells; adhesion; motility; cellular communication; signal transduction; biopolymers and networks; nerve cinduction; extracellular matrix; experimental methods; current research.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Biophysiscs and/or Physics of Complex Systems	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Sarah Köster	
<b>Course frequency:</b> sporadic	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> not limited		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module B.Phy.5617: Seminar: Physics of soft condensed matter</b>		2 WLH
<b>Learning outcome, core skills:</b> After successfully finishing this course, students will be able to work on specific questions with the help of book chapters or journal publications and to present the topic in a seminar talk.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Seminar: Physics of soft condensed matter</b>		
<b>Examination: Presentation with discussion (Bachelor approx. 30 min., Master approx. 60 min.)</b> <b>Examination prerequisites:</b> Active participation <b>Examination requirements:</b> Intermolecular interactions; phase transitions; interface physics; amphiphilic molecules; colloids; polymers; polymer networks; gels; fluid dynamics; self-organization.		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> <ul style="list-style-type: none"> <li>• Introduction to Biophysics and/or</li> <li>• Introduction to Complex Systems and/or</li> <li>• Introduction to Solid State Physics and/or</li> <li>• Introduction to Materials Physics</li> </ul>	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Sarah Köster	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 14		



<b>Georg-August-Universität Göttingen</b>		4 C 2 WLH
<b>Module B.Phy.5618: Seminar to Biophysics of the cell - physics on small scales</b>		
<b>Learning outcome, core skills:</b> After successfully finishing this course, students will be able to work on specific questions with the help of book chapters or journal publications and to present the topic in a seminar talk.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Seminar</b>		
<b>Examination: Presentation with discussion (Bachelor approx. 30 min., Master approx. 60 min.)</b> <b>Examination prerequisites:</b> Active participation <b>Examination requirements:</b> Physical principles in cells; adhesion; motility; cellular communication; signal transduction; biopolymers and networks; nerve conduction; extracellular matrix; experimental methods; current research.		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Biophysics and/or Introduction to Physics of Complex Systems	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Sarah Köster	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 6; Master: 1 - 4	
<b>Maximum number of students:</b> 14		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module B.Phy.5619: Seminar on Micro- and Nanofluidics</b>		2 WLH
<b>Learning outcome, core skills:</b> After successfully finishing this course, students will be able to work on specific questions with the help of book chapters or journal publications and to present the topic in a seminar talk.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Seminar on Micro- and Nanofluidics (Seminar)</b>		
<b>Examination: Presentation with discussion (Bachelor approx. 30 min., Master approx. 60 min.)</b> <b>Examination prerequisites:</b> Active participation <b>Examination requirements:</b> Fluid dynamics, hydrodynamics on the micro- and nanoscale and its applications in biology, biophysics, material sciences and biotechnology; wetting and capillarity; "life" at low Reynolds numbers; soft lithography; fluidics in biology and biophysics, "lab-on-a-chip" applications; Navier-Stokes-Equation.		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Biophysics and/or Physics of Complex Systems	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Sarah Köster	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 14		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module B.Phy.5620: Physics of Sports</b>		2 WLH
<b>Learning outcome, core skills:</b> After completing this module a student should be able to: <ul style="list-style-type: none"> <li>• Research a topic in the scientific literature and analyse it critically.</li> <li>• Show fundamental skills in model building and, for example, in the discussion of nonlinear differential equations or other complex physical models.</li> </ul>		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Seminar</b>		
<b>Examination: Presentation with discussion (approx. 45 minutes) and supplementary report (max. 4 pages)</b> <b>Examination prerequisites:</b> Active participation		
<b>Examination requirements:</b> The student should: Present a summary of the key physics underlying a particular sport; Explain the topic from intuition to a deep description of the relevant physical facts or foundation; Set up an appropriate model and discuss the solution. Where appropriate, the student must take into account a critical discussion of the relevant literature.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basic analytical mechanics and fluid dynamics.	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Stephan Herminghaus Contact persons: Dr. O. Bäumchen, Dr. M. Mazza	
<b>Course frequency:</b> unegular, two year as required	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 25		

<b>Georg-August-Universität Göttingen</b> <b>Module B.Phy.5621: Stochastic Processes</b>		4 C 2 WLH
<b>Learning outcome, core skills:</b> After successful completion of this course, students should, when asked, be able to employ the fundamental concepts of stochastic processes, that lie on the boundary between biology, physics and economics.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Seminar</b>		
<b>Examination: Presentation with discussion (approx. 60 minutes)</b> <b>Examination prerequisites:</b> Active Participation <b>Examination requirements:</b> Random walks, space-time propagation models (of information and epidemics); entropy concepts; Information theory for stochastic processes, Markov chains, Fokker-Planck formalism. The given presentation time includes time for the discussion.		
<b>Examination requirements:</b>		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Theo Geisel	
<b>Course frequency:</b> every 4th semester; two-year as required, summer semester or winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 4 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module B.Phy.5623: Theoretical Biophysics</b>		4 WLH
<b>Learning outcome, core skills:</b> <b>Learning outcome:</b> Basics of probability theory, Bayes Theorem, Brownian motion, stochastic differential equations, Langevin equation, path integrals, Fokker-Planck equation, Ornstein-Uhlenbeck processes, thermophoresis, chemotaxis, Fluctuation Dissipation Theorems, Stochastic Resonance, Thermal Ratchet, motor proteins, hydrodynamics at the nanoscale, population dynamics, Jarzynski relations, non-equilibrium thermodynamics, neural networks. <b>Core skills:</b> The core goal is to teach students fundamental theoretical concepts about stochastic systems in the widest sense, and the application of these concepts the biophysics of biomolecules, cells and populations.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Vorlesung mit Selbststudium Literatur</b>		
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> Derivation of fundamental relations describing stochastic systems, derivation, handling and explanation of differential equations, derivation of analytical and approximative solutions for the various considered problems.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Jörg Enderlein	
<b>Course frequency:</b> every 4th semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 4 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b> <b>Module B.Phy.5624: Introduction to Theoretical Neuroscience</b>		4 C 2 WLH
<b>Learning outcome, core skills:</b> After successfully completing this course, students should understand and be able to employ the fundamental concepts, model representations and mathematical methods of the theoretical physics of neuronal systems.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Seminar</b>		
<b>Examination: Lecture (approx. 60 minutes)</b> <b>Examination prerequisites:</b> Active Participation <b>Examination requirements:</b> Elementary knowledge of the construction, biophysics and function of nerve cells; probabilistic analysis of sensory encoding; simple models of the dynamics and information processing in networks of biological neurons; modelling of the biophysical foundations of learning processes.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Fred Wolf	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 4 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 25		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.5625: Röntgenphysik</b> <i>English title: X-ray physics</i>		6 C 4 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls können/sind die Studierenden... <ul style="list-style-type: none"> <li>• Experimente planen und durchführen;</li> <li>• Messzeiten an Großforschungseinrichtungen (Photonen, Neutronen) durchführen;</li> <li>• die Funktion von Großforschungseinrichtungen verstehen und eigene spätere Arbeiten dort als Nutzer vorbereiten;</li> <li>• die Funktion und Bedeutung der Kristallographie in Materialwissenschaft und Biowissenschaften verstehen;</li> <li>• den Zusammenhang zwischen Experiment und Theorie am Beispiel von Streuexperimenten erkennen;</li> <li>• mit den physikalischen Grundlagen des Strahlenschutzes vertraut;</li> <li>• physikalische Experimentiermethoden für Wissenschaftler anderer Disziplinen (Biologen, Chemiker, Materialwissenschaftler, Geowissenschaftler) kennen und anwenden.</li> </ul>		<b>Arbeitsaufwand:</b> Präsenzzeit: 56 Stunden Selbststudium: 124 Stunden
<b>Lehrveranstaltung: Röntgenphysik</b>		
<b>Prüfung: Klausur (120 min.) oder mündliche Prüfung (ca. 30 min.) oder Vortrag (ca. 30 min., 2 Wochen Vorbereitungszeit)</b> <b>Prüfungsanforderungen:</b> Aufgaben aus dem genannten Teilgebiet quantitativ lösen:  Physikalischen Grundlagen von Streuexperimenten zur Bestimmung von Struktur und Dynamik in kondensierter Materie und Biophysik; Charakterisierung von Struktur durch Korrelationsfunktionen; Elementaranregungen; Wellenoptik; experimentelle und instrumentelle Umsetzung; Röntgenoptik und Röntgenmikroskopie; Röntgenquellen		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> Elektrodynamik (Experimentalphysik II), Optik u. Wellenlehre (Experimentalphysik III), Quantenmechanik (Experimentalphysik IV) und Theorie-Vorlesung	
<b>Sprache:</b> Deutsch, Englisch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Tim Salditt	
<b>Angebotshäufigkeit:</b> mind. alle 2 Jahre	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 6; Master: 1 - 4	
<b>Maximale Studierendenzahl:</b> nicht begrenzt		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module B.Phy.5628: Pattern Formation</b>		4 WLH
<p><b>Learning outcome, core skills:</b></p> <p><b>Learning outcome:</b> Spatial patterns such as stripes or spots emerge in many physical systems, biology and beyond. This course will cover the mechanisms and most common examples of such patterns. We shall show how broad classes of nonlinear dynamical systems are related in terms of non-dimensional groups, and symmetries. Linear stability theory will be introduced to demonstrate the onset of emergent features, and amplitude equations will be derived around these instabilities to describe the rules of pattern selection (like spots or stripes). Finally, the significance of defects and their dynamics will be explored. Model systems such as convection cells, waves in excitable tissue, wrinkling, reaction-diffusion patterns and beyond will be introduced. Additional context and related questions of current research will be covered in talks by members of the Göttingen Research Campus.</p> <p><b>Core skills:</b> After successful completion of the modul, the students should...</p> <ul style="list-style-type: none"> <li>• know, how to approach the study of natural patterns in nonlinear systems from a rigorous physical perspective;</li> <li>• know, how to identify the conditions for the onset of a pattern, and to analyse pattern selection and stability;</li> <li>• be able to develop a familiarity with the principles of pattern formation, and apply these to a broad range of situations, from the large-scale structure of the universe, to a leopard's spots and flux tubes in superconductors;</li> <li>• be able to perform an in-depth investigation on a particular topic of their choice, and present this topic during class.</li> </ul>		<p><b>Workload:</b></p> <p>Attendance time: 56 h</p> <p>Self-study time: 124 h</p>
<p><b>Courses:</b></p> <p>1. lecture</p> <p>2. tutorial</p>		<p>2 WLH</p> <p>2 WLH</p>
<b>Examination: presentation (approx. 45 min) and handout (max. 4 pages)</b>		6 C
<p><b>Examination requirements:</b></p> <p>Modeling of an experimental system by identifying appropriate dimensionless variables; determining the stability threshold; deriving appropriate amplitude equations and discussing the pattern selection beyond the threshold of linear stability.</p>		
<p><b>Admission requirements:</b></p> <p>none</p>	<p><b>Recommended previous knowledge:</b></p> <p>Analytical Mechanics, basic knowledge on Partial Differential Equations.</p>	
<p><b>Language:</b></p> <p>English</p>	<p><b>Person responsible for module:</b></p> <p>apl. Prof. Dr. Jürgen Vollmer</p>	
<p><b>Course frequency:</b></p> <p>two year as required, summer or winter term</p>	<p><b>Duration:</b></p> <p>1 semester[s]</p>	
<p><b>Number of repeat examinations permitted:</b></p>	<p><b>Recommended semester:</b></p>	



three times	Bachelor: 5 - 6; Master: 1 - 4
<b>Maximum number of students:</b> 50	

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module B.Phy.5629: Nonlinear dynamics and time series analysis</b>		
<b>Learning outcome, core skills:</b> Sound knowledge and practical experience with methods and concepts from Nonlinear Dynamics and Time Series Analysis, mainly obtained by devising, implementing, and running algorithms and simulation programs.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Blockpraktikum</b>		
<b>Examination: Presentation with discussion (approx. 45 minutes) and written elaboration (max. 10 pages)</b> <b>Examination requirements:</b> <ul style="list-style-type: none"> <li>• Presentation of a specific topic</li> <li>• Report about own (simulation) results obtained for the specific topic</li> </ul>		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basic programming skills (for the exercises)	
<b>Language:</b> German, English	<b>Person responsible for module:</b> apl. Prof. Dr. Ulrich Parlitz	
<b>Course frequency:</b> sporadic	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 12		
<b>Additional notes and regulations:</b> (Duration: 2 weeks with 8h per day)		

<b>Georg-August-Universität Göttingen</b>		4 C 2 WLH
<b>Module B.Phy.5631: Self-organization in physics and biology</b>		
<b>Learning outcome, core skills:</b> <b>Learning outcome:</b> Non-linear dynamics, instabilities, basics of self-organisation, bifurcations, non-equilibrium thermodynamics: <b>Core skills:</b> Upon successful seminar participation, the students should be capable of - accomplish literature research autonomously and therefore understand and analyse scientific articles in the corresponding scientific context - create a presentation including physical and biological basics relevant to the scientific article and give the oral presentation		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Seminar</b>		
<b>Examination: Presentation (approx. 45 Min.)</b> <b>Examination prerequisites:</b> Active Participation <b>Examination requirements:</b> Elaborated presentation, which includes an introduction to the necessary basics		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> -Introduction to biophysics -Introduction to physics of complex systems	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Eberhard Bodenschatz Further contact person: Dr. M. Tarantola	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 10		

<b>Georg-August-Universität Göttingen</b>		4 C 2 WLH
<b>Module B.Phy.5632: Current topics in turbulence research</b>		
<b>Learning outcome, core skills:</b> <b>Learning outcome:</b> Based on a selected topic the students shall develop a basic understanding of turbulent flows. <b>Core skills:</b> The goal of this course is to enable the students to present their research in the context of the international state of the art of the field.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Seminar</b>		WLH
<b>Examination: Presentation (approx. 45 Min.)</b> <b>Examination prerequisites:</b> Active Participation <b>Examination requirements:</b> Basic understanding of turbulence; instabilities, scaling, models of turbulence, turbulence in rotating and stratified systems, turbulent heat transport, particles in turbulence		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basic knowledge of advanced continuum mechanics or electrodynamics.	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Eberhard Bodenschatz	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 15		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5639: Optical measurement techniques</b>		2 WLH
<b>Learning outcome, core skills:</b> After successful completion of the module, students should ... <ul style="list-style-type: none"> <li>• be able to apply light models</li> <li>• have understood basic optical principles of measurement</li> <li>• have gained an overview of optical measurement method for measuring different physical quantities at different scales</li> </ul>		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Optical Measurement Techniques (Lecture)</b>		
<b>Examination: Presentation with discussion (approx. 30 min.) or oral examination (approx. 30 Min.)</b> <b>Examination requirements:</b> Understanding optical measurement principles and methods		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> German, English	<b>Person responsible for module:</b> StudiendekanIn der Fakultät für Physik / Ansprechpartner: Dr. Nobach	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5642: Experimental Methods in Biophysics</b>		2 WLH
<b>Learning outcome, core skills:</b> After successful completion of this module, students know some fundamental physics of experimental methods used in biophysics and are able to adapt those to selected problems.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Lecture</b>		
<b>Examination: oral exam (approx. 15 Min.) or talk (approx. 30 Min.)</b> <b>Examination requirements:</b> Fundamental physics of experimental methods in biophysics, e.g. microscopy, atomic force microscopy, optical tweezers, data acquisition and analysis, image analysis, rheology		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Biophysics	
<b>Language:</b> English	<b>Person responsible for module:</b> Dr. Florian Rehfeldt	
<b>Course frequency:</b> every 4th semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 4 - 6; Master: 1 - 3	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module B.Phy.5643: Seminar: Experimental Methods in Biophysics</b>		2 WLH
<b>Learning outcome, core skills:</b> After successful completion of this module, students are able to present selected problems from literature in a seminar talk.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Experimental Methods in Biophysics</b>		
<b>Examination: Lecture (approx. 30 minutes)</b> <b>Examination prerequisites:</b> regular participation <b>Examination requirements:</b> Fundamental physics of experimental methods in biophysics, e.g. microscopy, atomic force microscopy, optical tweezers, data acquisition and analysis, image analysis, rheology.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Biophysics	
<b>Language:</b> English	<b>Person responsible for module:</b> Dr. Florian Rehfeldt	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 4 - 6; Master: 1 - 3	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5645: Nanooptics and Plasmonics</b>		2 WLH
<b>Learning outcome, core skills:</b> After the course, the students should have a profound knowledge about the rapidly evolving field nanooptics and plasmonics, both experimentally as well as theoretically.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Nanooptics and Plasmonics (Lecture)</b>		
<b>Examination: Written examination (90 min.) or oral examination (approx. 30 Min.)</b> <b>Examination requirements:</b> Electrodynamics of single particle/molecule emission, electrodynamic interaction of nano-emitters and molecules with light, interaction of light with nanoscale dielectric and plasmonic structures, and with optical metamaterials. Theory of light-matter interaction at the nanometer length scale. Fundamentals of optical microscopy and spectroscopy, applied to optical quantum emitters.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Experimental Physics I-IV	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Jörg Enderlein	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 4 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 20		



<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module B.Phy.5646: Climate Physics</b>		4 WLH
<p><b>Learning outcome, core skills:</b></p> <p><b>Learning outcome:</b> This course will introduce the physical principles of the Earth's climate, and the dynamics of our atmosphere and oceans. We will show how the basic features of a climate system can be understood through a detailed energy balance. A momentum balance, in the form of the Navier-Stokes equations, and mass balance, give rise to many of the additional behaviours of a real climate system. The main features of atmospheric and ocean circulation, mixing, and transport will be discussed in this context, including such topics as the thermohaline circulation; turbulent mixing; atmospheric waves; and Coriolis effects. We will then return to the global energy budget, and discuss physically grounded models of climate prediction and climate sensitivity (e.g. Milankovitch cycles), as well as their implications. In the latter part of the course, additional context on related questions of current research will be covered in special topics presented by members of the Göttingen Research Campus.</p> <p><b>Core skills:</b> After successful completion of the modul the students should ...</p> <ul style="list-style-type: none"> <li>• know how to approach the study of climate in planetary systems from a rigorous physical perspective;</li> <li>• know which factors influence the climate, and how to analyse climate patterns and stability;</li> <li>• be able to develop a familiarity with the principles of climate science, and apply these to a broad range of situations, from the large-scale convection patterns in atmospheres and oceans, to the impact of clouds and precipitation, and box models for the energy and entropy budget.</li> </ul>		<p><b>Workload:</b></p> <p>Attendance time: 56 h</p> <p>Self-study time: 124 h</p>
<b>Course: Lecture with exercises</b>		
<p><b>Examination: Written examination (120 Min.) or oral examination (approx. 30 Min.)</b></p> <p><b>Examination requirements:</b> Profound geophysical basis for the work on issues of climate physics.</p>		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basics of Hydrodynamics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> apl. Prof. Dr. Jürgen Vollmer	
<b>Course frequency:</b> two year as required, winter term or summer term	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 50		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module B.Phy.5647: Physics of Coffee, Tea and other drinks</b>		2 WLH
<b>Learning outcome, core skills:</b> After completing this module a student should be able to: <ul style="list-style-type: none"> <li>• Research a topic in the scientific literature and analyse it critically.</li> <li>• Show fundamental skills in model building and, for example, in the discussion of nonlinear differential equations or other complex physical models.</li> <li>• Understand the phase behaviour of two (or more) component mixtures, the kinetics of phase separation, the physics of multi-phase fluids and soft materials such as foams and gels.</li> </ul>		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Physics of Coffee, Tea and other drinks (Seminar)</b>		
<b>Examination: Presentation with discussion (approx. 45 minutes) and written elaboration (max. 4 pages)</b> <b>Examination prerequisites:</b> Active Participation <b>Examination requirements:</b> Presentation of a complex physical summary of the key physics underlying a mixed drink, or other beverage (e.g. drainage of foam in espresso, slow waves and convective stripes in latte macchiato, bubble formation and growth in champagne). Where appropriate, the student must take into account a critical discussion of the relevant literature.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basic analytical mechanics and fluid dynamics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Stephan Herminghaus Contact Person: Dr. M. Mazza	
<b>Course frequency:</b> unregular, two year as required	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 25		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module B.Phy.5648: Theoretical and Computational Biophysics</b>		2 WLH
<p><b>Learning outcome, core skills:</b></p> <p>This combined lecture and hands-on computer tutorial focuses on the basics of computational biophysics and deals with questions like "How can the particle dynamics of thousands of atoms be described precisely?" or "How does a sequence alignment algorithm function?" The aim of the lecture with exercises is to develop a physical understanding of those "nano machines" by using modern concepts of non-equilibrium thermodynamics and computer simulations of the dynamics on an atomistic scale. Moreover, the lecture shows (by means of examples) how computers can be used in modern biophysics, e.g. to simulate the dynamics of biomolecular systems or to calculate or refine a protein structure. No cell could live without the highly specialized macromolecules. Proteins enable virtually all tasks in our bodies, e.g. photosynthesis, motion, signal transmission and information processing, transport, sensor system, and detection. The perfection of proteins had already been highly developed two billion years ago. During the exercises, the knowledge presented in the lecture will be applied to practical examples to further deepen and strengthen the understanding. By completing homework sets, which will be distributed after each lecture, additional aspects of the addressed topics during the lecture shall be worked out. The homework sets will be collected during the corresponding exercises.</p>		<p><b>Workload:</b></p> <p>Attendance time: 28 h</p> <p>Self-study time: 92 h</p>
<b>Course: Theoretical and Computational Biophysics</b> (Lecture, Exercise)		
<p><b>Examination: Oral examination (approx. 30 minutes)</b></p> <p><b>Examination requirements:</b></p> <p>Protein structure and function, physics of protein dynamics, relevant intermolecular interactions, principles of molecular dynamics simulations, numeric integration, influence of approximations, efficient algorithms, parallel programming, methods of electrostatics, protonation balances, influence of solvents, protein structure determination (NMR, X-ray), principal component analysis, normal mode analysis, functional mechanisms in proteins, bioinformatics: sequence comparison, protein structure prediction, homology modeling, and hands-on computer simulation.</p>		4 C
<p><b>Admission requirements:</b></p> <p>none</p>	<p><b>Recommended previous knowledge:</b></p> <ul style="list-style-type: none"> <li>• Introduction to Biophysics</li> <li>• Introduction to Physics of Complex Systems</li> </ul>	
<p><b>Language:</b></p> <p>English, German</p>	<p><b>Person responsible for module:</b></p> <p>Hon.-Prof. Dr. Karl Helmut Grubmüller</p>	
<p><b>Course frequency:</b></p> <p>each winter semester</p>	<p><b>Duration:</b></p> <p>1 semester[s]</p>	
<p><b>Number of repeat examinations permitted:</b></p> <p>three times</p>	<p><b>Recommended semester:</b></p> <p>Bachelor: 5 - 6; Master: 1 - 4</p>	
<p><b>Maximum number of students:</b></p>		

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30	
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<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module B.Phy.5649: Biomolecular Physics and Simulations</b>		2 WLH
<p><b>Learning outcome, core skills:</b></p> <p><b>Learning objectives:</b> This combined lecture and hands-on computer tutorial offers the possibility to deepen the knowledge about theory and computer simulations of biomolecular systems, particularly proteins, and can be understood as continuation of the lecture with exercises "Theoretical and Computational Biophysics" (usually taking place in the previous winter semester). During the exercises, the knowledge presented in the lecture will be applied to practical examples to further deepen and strengthen the understanding. By completing homework sets, which will be distributed after each lecture, additional aspects of the addressed topics during the lecture shall be worked out. The homework sets will be collected during the corresponding exercises.</p> <p><b>Competencies:</b> Whereas the winter term lecture with exercises "Theoretical and Computational Biophysics" emphasized the principles of running and analysing simple atomistic force field-based simulations, this advanced course will broaden our view and introduce basic principles, concepts and methods in computational biophysics, particularly required to understand biomolecular function, namely thermodynamic quantities such as free energies and affinities. Further, inclusion of quantum mechanical simulation techniques will allow to also simulate chemical reactions, e.g., in enzymes.</p>		<p><b>Workload:</b></p> <p>Attendance time: 28 h</p> <p>Self-study time: 92 h</p>
<b>Course: Lecture with Exercises Biomolecular Physics and Simulations</b>		
<p><b>Examination: Oral examination (approx. 30 minutes)</b></p> <p><b>Examination requirements:</b></p> <p>Basic knowledge and understanding of the material covered in the course such as: Free energy calculations, Rate Theory, Non-equilibrium thermodynamics, Quantum mechanical methods (Hartree-Fock and Density Functional Theory), enzymatic catalysis; "hands-on" computational calculations and simulations</p>		4 C
<p><b>Admission requirements:</b></p> <p>none</p>	<p><b>Recommended previous knowledge:</b></p> <p>B.Phy.5648 Theoretical and Computational Biophysics</p>	
<p><b>Language:</b></p> <p>English, German</p>	<p><b>Person responsible for module:</b></p> <p>Hon.-Prof. Dr. Karl Helmut Grubmüller</p>	
<p><b>Course frequency:</b></p> <p>each summer semester</p>	<p><b>Duration:</b></p> <p>1 semester[s]</p>	
<p><b>Number of repeat examinations permitted:</b></p> <p>three times</p>	<p><b>Recommended semester:</b></p> <p>Bachelor: 5 - 6; Master: 1 - 4</p>	
<p><b>Maximum number of students:</b></p> <p>30</p>		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5651: Advanced Computational Neuroscience</b>		2 WLH
<b>Learning outcome, core skills:</b> Participants in the course can explain and relate biological foundations and mathematical modelling of selected (neuronal) algorithms for learning and pattern formation.  Based on the the algorithms' properties, they can discuss and derive possible technical applications (robots).		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Advanced Computational Neuroscience I</b> (Lecture)		
<b>Examination: Written examination (90 Min.) or oral examination (approx. 20 Min.)</b> <b>Examination requirements:</b> Algorithms for learning: <ul style="list-style-type: none"> <li>• Unsupervised Learning (Hebb, Differential Hebb),</li> <li>• Reinforcement Learning,</li> <li>• Supervised Learning</li> </ul> Algorithms for pattern formation.  Biological motivation and technical Application (robots).		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basics Computational Neuroscience	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Florentin Andreas Wörgötter	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 50		
<b>Additional notes and regulations:</b> Hinweis: Die B.Phy.5652 kann als vorlesungsbegleitendes Praktikum besucht werden.		

<b>Georg-August-Universität Göttingen</b>		3 C 2 WLH
<b>Module B.Phy.5652: Advanced Computational Neuroscience II</b>		
<b>Learning outcome, core skills:</b> Participants in the course can implement, test, and evaluate the properties of selected (neuronal) algorithms for learning and pattern formation.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Advanced Computational Neuroscience II</b>		
<b>Examination: 4 Protocols (max. 3 Pages) and Presentations (ca. 10 Min.), not graded</b> <b>Examination requirements:</b> Algorithms for learning: <ul style="list-style-type: none"> <li>• Unsupervised Learning (Hebb, Differential Hebb),</li> <li>• Reinforcement Learning,</li> <li>• Supervised Learning</li> </ul> Algorithms for pattern formation. Biological motivation and technical Application (robots). <i>For each of the 4 programming assignments 1 protocol (ca. 3 pages) and 1 oral presentations (demonstration and discussion of the program, ca. 10 min).</i>		3 C
<b>Admission requirements:</b> B.Phy.5651 (can be taken in parallel to B.Phy.5652)	<b>Recommended previous knowledge:</b> Programming in C++, basic numerical algorithms, Grundlagen Computational Neuroscience B.Phy.5504: Computational Physics (Scientific Computing)	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Florentin Andreas Wörgötter	
<b>Course frequency:</b> unregelmäßig	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 24		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.5655: Komplexe Dynamik physikalischer und biologischer Systeme</b> <i>English title: Complex dynamics of physical and biological systems</i>		4 C 2 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollen die Studierenden in Lage sein, sich ausgewählte Themen und Fragestellungen anhand von Publikationen in Fachzeitschriften oder Büchern zu erarbeiten und einem Vortrag vorzustellen.		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 92 Stunden
<b>Lehrveranstaltung: Komplexe Dynamik physikalischer und biologischer Systeme</b> (Seminar)		
<b>Prüfung: Vortrag (ca. 30 Minuten)</b> <b>Prüfungsvorleistungen:</b> aktive Teilnahme <b>Prüfungsanforderungen:</b> Nichtlineare Dynamik, Biophysik, komplexe Netzwerke, erregbare Medien, Herzdynamik, Kardiomyozyten, Datenanalyse, experimentelle Techniken (z.B. Bildgebende Verfahren).		4 C
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> Einführung in die Biophysik / Einführung in die Physik komplexer Systeme	
<b>Sprache:</b> Deutsch, Englisch	<b>Modulverantwortliche[r]:</b> apl. Prof. Dr. Ulrich Parlitz	
<b>Angebotshäufigkeit:</b> jedes Sommersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 4 - 6; Master: 1 - 2	
<b>Maximale Studierendenzahl:</b> 20		



<b>Georg-August-Universität Göttingen</b>		3 C 3 WLH
<b>Module B.Phy.5656: Experimental work at large scale facilities for X-ray photons</b>		
<b>Learning outcome, core skills:</b> The goal of this course is to acquire the competence to perform experiments at modern synchrotron sources and free-electron-laser sources (large scale facilities) in a team; this includes the theoretical and experimental preparation of such beam times, as well as the experiment itself and the data analysis;  Competences: after successfully finishing this course, students should have the theoretical basis as well as the experimental abilities for performing modern X-ray experiments and should have applied their knowledge to specific examples from biophysics, soft matter physics and materials physics.		<b>Workload:</b> Attendance time: 42 h Self-study time: 48 h
<b>Course: Lab Course</b> <i>Contents:</i> Lab course during an x-ray beam time performed by the Institute for X-Ray Physics at a national or international source (in particular DESY, BESSY, XFEL, ESRF, SLS, NSLSII, SACLA, Diamond, Soleil, Elettra); students will already be involved in the preparation and will thus be well prepared for the experimental approach. At the x-ray source, they experience the technical/experimental as well as the theoretical part of the work; after the campaign, they learn modern methods of data analysis by direct interaction with the project leaders.		
<b>Examination: Written report (max. 10 p.) or oral examination (approx. 30 min.) about the finished scientific project, not graded</b> <b>Examination prerequisites:</b> Active participation at an X-ray beam time, including preparation and post-processing <b>Examination requirements:</b> Description of the scientific project, including the theoretical background and the experimental challenges and approaches; description of the data analysis and the results; discussion within the scientific context.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Good basic knowledge of physics (semesters 1-4) and good or very good knowledge of biophysics and x-ray optics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Sarah Köster Prof. Dr. Tim Salditt	
<b>Course frequency:</b> each semester; every semester, depending of availability of X-ray beam times	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	

**Additional notes and regulations:**

Maximum number of students: 2/beam time; if there are more applicants than slots, participants will be selected according to their experience and knowledge

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5657: Biophysics of gene regulation</b>		2 WLH
<b>Learning outcome, core skills:</b> <b>Objectives:</b> The students will learn basic concepts of the biophysics of gene regulation, including physical mechanisms and their physiological functions, as well as the methods for the theoretical analysis of such systems and their dynamics. <b>Competences:</b> After successful participation in the module, students should be able to analyze problems in gene regulation using the theoretical tools discussed in the lecture.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Biophysics of gene regulation (Lecture)</b> <i>Course frequency: each winter semester</i>		WLH
<b>Examination: written examination (60 Min.) or oral examination (approx. 30 Min.)</b> <b>Examination requirements:</b> Physical principles of gene regulation, mechanisms of regulation, thermodynamic modelling, deterministic and stochastic dynamics		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basic knowledge in statistical physics and biophysics	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Stefan Klumpp	
<b>Course frequency:</b> every 4th semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> not limited		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module B.Phy.5658: Statistical Biophysics</b>		4 WLH
<b>Learning outcome, core skills:</b> <b>Objectives:</b> The students will learn basic concepts of statistical biophysics at the molecular, cellular and population level, as well as methods for the theoretical analysis of biophysical systems. <b>Competences:</b> After successful participation in the module, students should have working knowledge of basic concepts of statistical biophysics and be able to apply them to selected problems.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Statistical Biophysics (Lecture with integrated problem sessions)</b> <i>Course frequency: each winter semester</i>		WLH
<b>Examination: written examination (120 Min.) or oral examination (approx. 30 Min.)</b> <b>Examination requirements:</b> Physical principles of biological systems on the molecular, cellular and population level, application of methods from statistical physics to biological and biophysical problems.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basic knowledge in biophysics and statistical physics	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Stefan Klumpp	
<b>Course frequency:</b> every 4th semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> not limited		

<b>Georg-August-Universität Göttingen</b> <b>Module B.Phy.5659: Seminar on current topics in theoretical biophysics</b>		4 C 2 WLH
<b>Learning outcome, core skills:</b> <b>Objectives:</b> The students will develop a basic understanding of current topics and methods of theoretical biophysics at the molecular, cellular and population level, based on selected examples. <b>Competences:</b> After completing this module, the students should be able to research a topic in theoretical biophysics in the scientific literature, analyse it critically and present it in a seminar talk.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Seminar on current topics in theoretical biophysics</b>		
<b>Examination: Presentation with discussion (Bachelor approx. 30 min., Master approx. 60 min.)</b> <b>Examination prerequisites:</b> Active participation <b>Examination requirements:</b> Presentation of a selected research topic and critical discussion of its methods and results		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basic knowledge in biophysics and statistical physics	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Stefan Klumpp	
<b>Course frequency:</b> every 4th semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 6; Master: 1 - 4	
<b>Additional notes and regulations:</b>		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5660: Theoretical Biofluid Mechanics</b>		2 WLH
<b>Learning outcome, core skills:</b> The course will discuss the theoretical foundations of fluid mechanics used in the study of biological systems. Important concepts in the mathematical study of fluids will be introduced and employed to investigate blood flow and circulation, the propulsion of organisms and transport facilitated by fluid flow. Students will learn to set up theoretical models for a range of biological systems involving fluids employing the Navier-Stokes equation and appropriate boundary conditions. The course will prepare the students to simplify, assess and analyze models to investigate the intricate role of fluids in biological settings.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Theoretical Biofluid Mechanics (Lecture)</b>		
<b>Examination: Written exam (60 minutes) or oral exam (approx. 30 minutes)</b> <b>Examination requirements:</b> Solving Navier-Stokes equation in simple geometry, derive simplified equations from models of fluid flow and transport, explore theoretical models in limiting parameter range and assess prediction in relation to modeled biological system.  The exam will be oral, if max. 20 students take part at the first date of the course. Otherwise it will be a written exam.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basic knowledge of calculus and algebra	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Stefan Klumpp Contact: Karin Alim	
<b>Course frequency:</b> every 4th semester; Every second Summerterm in Rotation to Microfluidic	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 3 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> not limited		

<b>Georg-August-Universität Göttingen</b>		4 C 2 WLH
<b>Module B.Phy.5661: Biomedical Techniques in Complex Systems</b>		
<b>Learning outcome, core skills:</b> The seminar provides an overview of current biomedical techniques applied in research and therapy. A strong orientation towards the combination of theoretical basics and practical use will be given by introducing up-to-date research results (original articles and text book material). Besides getting a deeper understanding of current biomedical techniques, the students will learn how to prepare and present up-to-date scientific results. This includes literature research, understanding of underlying methodological basics and didactic preparation (talk in front of the seminar participants).		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Biomedical Techniques in Complex Systems (Seminar)</b>		
<b>Examination: Oral examination, (Bachelor: approx. 30 min.; Master: approx. 45 min.)</b> <b>Examination requirements:</b> The students will elaborate and give a presentation about current biomedical techniques. The talk should include an introductory part to the underlying basics.		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Stefan Luther	
<b>Course frequency:</b> each winter semester1	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> not limited		
<b>Additional notes and regulations:</b> Contact: Dr. C. Richter		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module B.Phy.5662: Active Soft Matter</b>		2 WLH
<p><b>Learning outcome, core skills:</b>  Students acquire in depth expertise in the discipline of Active Soft Matter, focussed on artificial and biological microswimmers in experiment and theory. Topics include self-propulsion at low Reynolds numbers, chemo-, electro-, magneto-, gravi- and phototaxis, active droplets, colloids and Janus particles, dynamics of flagellae and ciliae in bacteria and algae, interaction with interfaces and complex geometries, collective and swarming dynamics and active emulsions.</p> <p>Core skills include the independent study of literature on current research, and the condensation, presentation and discussion of a specific topic, which are vital skills pertaining to presenting your own research and its position in a wider research field. Students will practice the critical appreciation of current research in scientific discussion and receive feedback on their presentation skills.</p>		<p><b>Workload:</b>  Attendance time: 28 h  Self-study time: 92 h</p>
<b>Course: Active Soft Matter</b> (Seminar)		
<p><b>Examination: Oral presentation (approx. 45 min.) and handout (4 pages max.)</b>  <b>Examination requirements:</b>  Preparation, presentation and discussion of a current topic in active soft matter based on published literature. Active engagement in discussions on other student's presentations. Handouts must be submitted before the presentation.</p>		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> introductory hydrodynamics and thermodynamics	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Stephan Herminghaus	
<b>Course frequency:</b> every 3rd semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 26		
<b>Additional notes and regulations:</b> Contact: Dr. Oliver Bäumchen, Dr. Corinna Maaß,		



<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module B.Phy.5663: Stochastic Dynamics</b>		6 WLH
<b>Learning outcome, core skills:</b> <b>Lernziele:</b> The students will learn basic concepts and the dynamic equations of stochastic dynamics as well as methods for their theoretical and computational analysis. <b>Kompetenzen:</b> After successful participation in the module, students should have working knowledge of basic concepts and methods of stochastic dynamics and be able to apply them to selected problems.		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Courses:</b> 1. <b>Stochastic Dynamics</b> (Lecture) 2. <b>Stochastic Dynamics</b> (Exercise)		4 WLH 2 WLH
<b>Examination: written examination (120 Min.) or oral examination (approx. 30 Min.) or small project with written term paper (approx. 8-10 pages)</b> <b>Examination requirements:</b> Approaches to stochastic dynamics and dynamic equations (random walks, Master equation, Langevin equation, Fokker-Planck equation), analytical solution methods, simulation algorithms.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Basic knowledge of statistical physics and programming	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Stefan Klumpp	
<b>Course frequency:</b> every 4th semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> not limited		

<b>Georg-August-Universität Göttingen</b> <b>Module B.Phy.5664: Excursion to DESY and the European XFEL, Hamburg</b>	3 C 2 WLH
<b>Learning outcome, core skills:</b> <b>Learning goals:</b> Basic knowledge about mission of large scale reasearch facilities, user concept and mission of DESY and European Free-electron laser (XFEL). Basic concepts of modern accelerators (super conducting and conventional), generation of synchrotron and FEL radiation, and fields of applications. <b>Competencies:</b> Overview about research and career opportunities at DESY and XFEL and how large scale facilities can be used for research and study topics. Categorize interdisciplinary information gathered at the excursion (presentations, poster session, workshop) and place it in perspective with own study background.	<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Excursion to DESY and the European XFEL, Hamburg (Excursion)</b>	
<b>Examination: oral presentation of one of the scientific activities at DESY (approx. 20min+10min discussion), Poster on a corresponding research topic, or approx. 4 pages contribution to the excursion protocol., not graded</b> <b>Examination prerequisites:</b> Participation in the excursion and discussion of prepared lerning material <b>Examination requirements:</b> Basic knowledge about mission of large scale reasearch facilities, user concept and mission of DESY and European Free-electron laser (XFEL). Basic concepts of modern accelerators (super conducting and conventional), generation of synchrotron and FEL radiation, and fields of applications.	3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> B.Phy.5625: Röntgenphysik
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Tim Salditt
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4
<b>Maximum number of students:</b> 10	

<b>Georg-August-Universität Göttingen</b> <b>Module B.Phy.5665: Processing of Signals and Measured Data</b>		3 C 2 WLH
<b>Learning outcome, core skills:</b> <b>Learning outcome:</b> <ul style="list-style-type: none"> <li>• Errors, e.g. systematic vs. random, static vs. dynamic, error propagation</li> <li>• Extraction of relevant information (separating trends, stochastic data and affecting influences, such as noise)</li> <li>• Stationarity, statistical quantities and functions</li> <li>• Characteristics of estimators (e.g., sufficiency, ergodicity, bias freeness, efficiency), Cramer-Rao bound, Bessel's correction</li> <li>• Sampling (equidistant and non-uniform), Possibility of reconstruction, sampling theorem, aliasing</li> <li>• Signal transformations (e.g. cosine, Fourier, Hilbert, Laplace, wavelet, z transform) and signal decomposition (e.g. Proper Orthogonal Decomposition, Independent Component Analysis)</li> <li>• Correlation functions and spectra, Wiener-Khinchin theorem</li> <li>• preferred acquisition, sample weighting</li> <li>• Window functions, moving average</li> </ul> <b>Core skills:</b> <ul style="list-style-type: none"> <li>• Specification of a measurement (sampling rate, duration, amount of data)</li> <li>• Bias-free and most efficient signal and data processing of measured data</li> <li>• Programming in Matlab or Python</li> </ul>		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Processing of Signals and Measured Data</b>		2 WLH
<b>Examination: Presentation or oral exam (ca. 30 Min.)</b> <b>Examination requirements:</b> Efficient use of signal and image processing methods as well as statistical analysis methods.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Eberhard Bodenschatz	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.5701: Weiche Materie: Flüssigkristalle</b> <i>English title: Soft matter: liquid crystals</i>		3 C 2 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden mit den grundlegenden Eigenschaften von thermotropen Flüssigkristallen vertraut sein und die grundlegenden Konzepte zur Beschreibung von Festkörpern und Flüssigkeiten auf Flüssigkristalle anwenden können.		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 62 Stunden
<b>Lehrveranstaltung: Vorlesung</b>		
<b>Prüfung: Vortrag oder mündliche Prüfung (je ca. 30 Min.) oder Klausur (90 Min.)</b>		
<b>Prüfungsanforderungen:</b> Nematische Flüssigkristalle: anisotrope Eigenschaften; Orientierungsverteilung und Ordnungsparameter; Theorien zum nematisch-isotrop Phasenübergang; Direktorfeld, elastische Eigenschaften und Kontinuumsbeschreibung; Wirkung äußerer Felder und Frederiks-Übergang; Eigenschaften der chiral-nematischen Phase; Flüssigkristalldisplays; smektische Flüssigkristalle: Phasen- und Strukturübersicht; Eigenschaften der smektischen A und C Phase; diskotische und columnare Flüssigkristalle; lyotrope Flüssigkristalle und biologische Aspekte.		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> Experimentalphysik I-III	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> StudiendekanIn der Fakultät für Physik; Ansprechpartner C. Bahr	
<b>Angebotshäufigkeit:</b> jedes Wintersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 5 - 6; Master: 1	
<b>Maximale Studierendenzahl:</b> 40		
<b>Bemerkungen:</b> Schwerpunkte: Biophysik/Komplexe Systeme Materialphysik Prüfungsart wird bei Vorlesungsbeginn entsprechend der Anzahl der Teilnehmer festgelegt.		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.5702: Dünne Schichten</b> <i>English title: Thin Layers</i>		3 C 2 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden die grundlegenden Begriffe der Physik dünner Schichten und Schichtstrukturen anwenden können.		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 62 Stunden
<b>Lehrveranstaltung: Vorlesung mit Seminar (je zur Hälfte)</b>		
<b>Prüfung: Vortrag (ca. 30 Minuten)</b> <b>Prüfungsvorleistungen:</b> Aktive Teilnahme im Seminar		
<b>Prüfungsanforderungen:</b> Oberflächen; UHV; Dünnschichtverfahren; Keimbildung und Wachstum dünner Schichten; Epitaxie; Untersuchungsmethoden; spezielle Eigenschaften dünner Schichten.		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> StudiendekanIn der Fakultät für Physik	
<b>Angebotshäufigkeit:</b> unregelmäßig	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 6; Master: 1 - 4	
<b>Maximale Studierendenzahl:</b> 24		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module B.Phy.5709: Seminar on Nanoscience</b>		2 WLH
<b>Learning outcome, core skills:</b> <b>Lernziele:</b> Electronic properties of electrons confined in low-dimensional structures (2D, 1D and 0D). Experimental methods for the preparation and characterization of nanostructures. Functional nanostructures. Devices in nanoelectronics. Semiconductor materials will be on focus. <b>Kompetenzen:</b> After successful completion of the modul the students should be able to gain a deep knowledge of a current topic in nanoscience and nanodevices from the recommended scientific literature. The student will present and discuss the topic in a Seminar.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Seminar (Blockveranstaltung)</b>		
<b>Examination: Vortrag (ca. 30 Min.) - student choice if in German or in English</b> <b>Examination prerequisites:</b> Aktive Teilnahme		
<b>Examination requirements:</b> The students should achieve a deep knowledge of a current topic in nanoscience and nanodevices from the recommended scientific literature; the student should be able to transfer this knowledge to an audience in a seminar.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> <ul style="list-style-type: none"> <li>• Einführung in die Festkörperphysik</li> <li>• Einführung in die Materialphysik</li> <li>• Quantenmechanik I</li> <li>• Nanoscience</li> </ul>	
<b>Language:</b> English	<b>Person responsible for module:</b> StudiendekanIn der Fakultät für Physik	
<b>Course frequency:</b> unregelmäßig	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 2	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module B.Phy.5714: Introduction to Solid State Theory</b>		6 WLH
<b>Learning outcome, core skills:</b> <b>Lernziele:</b> Fundamental concepts of solid state theory, Born-Oppenheimer approximation, homogeneous electron gas, electrons in lattices, lattice vibrations, elementary transport theory <b>Kompetenzen:</b> After successful completion of the modul students should be able to describe and calculate fundamental properties of solids; understand and use the language of solid-state theory.		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Courses:</b> <b>1. lecture</b> <b>2. exercises</b>		4 WLH 2 WLH
<b>Examination: Written examination (90 minutes)</b> <b>Examination requirements:</b> Application of fundamental concepts in solid state theory, interpretation of basic experimental observations, theoretical description of fundamental phenomena in solid state physics.		6 C
<b>Admission requirements:</b> keine	<b>Recommended previous knowledge:</b> Quantum mechanics I	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Thomas Pruschke Prof. Kehrein	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> not limited		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module B.Phy.5716: Nano-Optics meets Strong-Field Physics</b>		4 WLH
<b>Learning outcome, core skills:</b> At the end of the course, students should understand and be able to apply the basic concepts of nano-optics and strong-field physics, as well as their connection in modern research. In the accompanying exercises, numerical simulations will be developed which build on the topics discussed in the lectures. An introduction will be given to scripting in Matlab and to finite element simulations with Comsol Multiphysics.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Courses:</b> <b>1. Vorlesung</b> <b>2. Übung</b>		2 WLH 2 WLH
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination prerequisites:</b> Implementation of a task in an executable programme.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Experimentalphysik I-IV, Quantenmechanik	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Claus Ropers StudiendekanIn der Fakultät für Physik	
<b>Course frequency:</b> unregelmäßig	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 20		



<b>Georg-August-Universität Göttingen</b> <b>Module B.Phy.5717: Mechanisms and Materials for Renewable Energy</b>		6 C 4 WLH
<b>Learning outcome, core skills:</b> By participation in both lectures on photovoltaics and solar thermal energy, thermoelectrics and solar fuels students gain knowledge about the full spectrum of physical and chemical basics of renewable energy conversion. In addition, overlapping aspects of fundamental concepts and technological approaches have been reviewed. Students shall independently apply gained knowledge to acquire and present current research in the field.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Mechanismen und Materialien für erneuerbare Energien (Lecture)</b>		
<b>Examination: Poster presentation with oral examination (approx. 30 Min.)</b> <b>Examination requirements:</b> Beherrschung der grundlegenden Begriffe, Fakten und Methoden. Selbständige Erarbeitung wissenschaftlicher Publikationen und deren Präsentation.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to solid state physics, Introduction to materials physics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> apl. Prof. Dr. Michael Seibt Prof. Dr. Christian Jooß	
<b>Course frequency:</b> two-year as required, summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 6; Master: 1 - 2	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b>		4 C 2 WLH
<b>Module B.Phy.5718: Mechanisms and Materials for Renewable Energy: Photovoltaics</b>		
<b>Learning outcome, core skills:</b> After successful completion of this module students are familiar with physical basics or photo-electric energy conversion, are able to apply fundamental concepts and gained knowledge about important materials systems of photovoltaics. In addition, important experimental methods as well as current and future technological concepts have been reviewed. Students shall independently apply gained knowledge to acquire and present current research in the field.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Mechanismen und Materialien für erneuerbare Energien: Photovoltaik (Lecture)</b>		
<b>Examination: Poster presentation with oral examination (approx. 30 Min.)</b> <b>Examination requirements:</b> Beherrschung der grundlegenden Begriffe, Fakten und Methoden. Selbständige Erarbeitung wissenschaftlicher Publikationen und deren Präsentation.		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to solid state physics, Introduction to Materials physics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> apl. Prof. Dr. Michael Seibt	
<b>Course frequency:</b> zweijährig im SoSe	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 6; Master: 1 - 2	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b> <b>Module B.Phy.5719: Mechanisms and Materials for Renewable Energy: Solar heat, Thermoelectric, solar fuel</b>		4 C 2 WLH
<b>Learning outcome, core skills:</b> Physical and chemical basics of light and heat conversion to electrical and chemical energy. <ul style="list-style-type: none"> <li>• In particular: Mechanisms of solarthermic, thermoelectric, electro- and photochemical energy conversion.</li> <li>• Important model systems and materials.</li> <li>• Outlook in current research activities.</li> </ul> Students shall independently apply gained knowledge to acquire and present current research on relevant systems.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Mechanismen und Materialien für erneuerbare Energien: Solarthermie, Thermoelektrik, solarer Treibstoff (Lecture)</b>		
<b>Examination: Posterpresentation with oral examination (approx. 30 Min.)</b> <b>Examination requirements:</b> Beherrschung der grundlegenden Begriffe, Fakten und Methoden. Selbständige Erarbeitung wissenschaftlicher Publikationen und deren Präsentation.		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to solid state physics, Introduction to Materials Physics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Christian Jooß	
<b>Course frequency:</b> two-year as required, summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 6; Master: 1 - 2	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b>		3 C 2 WLH
<b>Module B.Phy.5720: Introduction to Ultrashort Pulses and Nonlinear Optics</b>		
<b>Learning outcome, core skills:</b> After successful completion of this Module students will be able to work with advanced concepts, phenomena and models of ultrashort pulses and their applications in nonlinear optics.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Introduction to Ultrashort Pulses and Nonlinear Optics (Lecture)</b>		
<b>Examination: Oral (approx. 30 min.) or written (90 min.)</b> <b>Examination requirements:</b> Matter-light interaction; rate equations; continuous and pulsed laser operation; mode coupling; properties of ultrashort pulses; nonlinear susceptibility and nonlinear response of bound electrons; frequency doubling; parametric amplification; self-focusing; self-phase modulation; high-harmonic generation		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> <ul style="list-style-type: none"> <li>• Elektrodynamik (Experimentalphysics II)</li> <li>• Optic and waves (Experimentalphysics III)</li> </ul>	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Stefan Mathias	
<b>Course frequency:</b> every 4th semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module B.Phy.5721: Information and Physics</b>		6 WLH
<b>Learning outcome, core skills:</b> Understanding the concept of information in classical physics and quantum physics, in depth understanding of the second law of thermodynamics and its generalizations with the Landauer erasure principle, learning key elements of quantum information theory and quantum computation		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Course: Information and Physics</b> (Lecture, Exercise)		
<b>Examination: Written examination (120 minutes)</b> <b>Examination requirements:</b> Understanding the concepts of classical and quantum information science, performing calculations in classical and quantum information science and interpreting the results		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Analytical Mechanics, Quantum Mechanics and Statistical Physics	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Stefan Kehrein	
<b>Course frequency:</b> every 4th semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 6; Master: 1 - 4	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module B.Phy.5722: Seminar on Topics in Nonlinear Optics</b>		2 WLH
<b>Learning outcome, core skills:</b> This seminar addresses some of the most important nonlinear optical phenomena and their application. Exemplary topics will be parametric processes and wave mixing, high harmonic generation, spatial and temporal solitons, supercontinuum generation, optical phase conjugation, stimulated Raman scattering, photorefractive phenomena, optical filamentation and electromagnetically induced transparency.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Seminar on Topics in Nonlinear Optics (Seminar)</b>		
<b>Examination: Presentation with discussion (Bachelor approx. 30 min., Master approx. 60 min.)</b> <b>Examination prerequisites:</b> compulsory attendance <b>Examination requirements:</b> A fundamental understanding of nonlinear optical phenomena and their application.		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Claus Ropers	
<b>Course frequency:</b> every 4th semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 14		

<b>Georg-August-Universität Göttingen</b>		3 C 3 WLH
<b>Module B.Phy.5723: Hands-on course on Density-Functional calculations 1</b>		
<b>Learning outcome, core skills:</b> Students will be able to perform first-principles electronic-structure and ab-initio molecular dynamics simulations, understand the results and judge their accuracy. They will have a basic knowledge of the underlying methods. They will know simple methods of anticipating and describing electronic and atomic structure and chemical bonds.	<b>Workload:</b> Attendance time: 40 h Self-study time: 50 h	
<b>Course: Hands-on course on Density-Functional calculations 1 (Block course)</b> <i>Contents:</i> 1. Theoretical foundation of first-principles calculations (lecture 10 h) 2. Simple concepts of electronic structure and chemical binding (lecture 10 h) 3. Hands on Course with the CP-PAW code (Exercise 20 h)		
<b>Examination: oral (approx 30 min), presentation (30 min) or report</b> <b>Examination prerequisites:</b> regular participation <b>Examination requirements:</b> The student is able to describe topics from the course and to respond to questions. A presentation or a report will describe a specified home project.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Bloechl	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 6; Master: 1 - 4	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b> <b>Module B.Phy.5724: Hands-on course on Density-Functional calculations 1+2</b>	6 C 6 WLH
<b>Learning outcome, core skills:</b> Students will be able to perform first-principles electronic-structure and ab-initio molecular dynamics simulations, understand the results and judge their accuracy. They will have a basic knowledge of the underlying methods. They will know simple methods of anticipating and describing electronic and atomic structure and chemical bonds.	<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Course: Hands-on course on Density-Functional calculations 1+2 (Block course)</b> <i>Contents:</i> 1. Theoretical foundation of first-principles calculations (lecture 10 h) 2. Simple concepts of electronic structure and chemical binding (lecture 10 h) 3. Hands on Course with the CP-PAW code (Exercise ~22 h) 4. Advanced topics of first-principles calculations (lecture ~8 h) 5. Hands on Course: guided projects (~26 h) 6. Seminar on guided projects (~12 h)	
<b>Examination: oral (approx 30 min), presentation (30 min) or report</b> <b>Examination prerequisites:</b> regular participation <b>Examination requirements:</b> The student is able to describe topics from the course and to respond to questions. A presentation or a report will describe a specified project.	3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Bloechl
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 6; Master: 1 - 4
<b>Maximum number of students:</b> 20	



<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module B.Phy.5804: Quantum mechanics II</b>		6 WLH
<b>Learning outcome, core skills:</b> <b>Acquisition of knowledge:</b> Scattering theory; Symmetries in QM, especially angular momentum and spin; Many particle systems and Fock formalism; Quantization of the electromagnetic field; Relativistic QM: Klein-Gordon equation and Dirac equation in external fields. <b>Competencies:</b> The students shall be familiar with advanced concepts of Quantum Mechanics. They can apply them to explicit examples.		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Courses:</b> 1. <b>Quantum mechanics II</b> (Lecture) 2. <b>Quantum mechanics II</b> (Exercise)		4 WLH 2 WLH
<b>Examination: Written examination (120 minutes)</b> <b>Examination requirements:</b> Solution of concrete problems treated in the lecture course. Explanation of notions and methods of advanced QM.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Quantum mechanics I, Classical field theory	
<b>Language:</b> English	<b>Person responsible for module:</b> apl. Prof. Dr. Karl-Henning Rehren	
<b>Course frequency:</b> once a year	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 3	
<b>Maximum number of students:</b> 80		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module B.Phy.5805: Quantum field theory I</b>		6 WLH
<b>Learning outcome, core skills:</b> <b>Acquisition of knowledge:</b> Quantization of free relativistic wave equations (Klein-Gordon and Dirac); General properties of quantum fields; Interaction with external sources; Perturbation theory and basics of renormalization theory; Quantum Electro Dynamics and abelian gauge symmetry. <b>Competencies:</b> The students shall be familiar with the basic concepts and methods of Quantum Field Theory. They can apply them to explicit examples.		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Courses:</b> 1. <b>Quantum field theory I</b> (Lecture) 2. <b>Quantum field theory I</b> (Exercise)		4 WLH 2 WLH
<b>Examination: Written examination (120 minutes)</b> <b>Examination requirements:</b> Solution of concrete problems treated in the lecture course. Explanation of notions and methods of Quantum Field Theory.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Quantum mechanics I, II, Classical Field theory	
<b>Language:</b> English	<b>Person responsible for module:</b> apl. Prof. Dr. Karl-Henning Rehren	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 6; Master: 1 - 2	
<b>Maximum number of students:</b> 50		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.5806: Spezielle Relativitätstheorie</b> <i>English title: Special relativity theory</i>		3 C 2 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden... <ul style="list-style-type: none"> <li>• mit der Lorentzgruppe umgehen können;</li> <li>• ein Verständnis der Raum-Zeit-Konzepte entwickelt haben;</li> <li>• Gedankenexperimente einsetzen können.</li> </ul>		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 62 Stunden
<b>Lehrveranstaltung: Vorlesung</b>		
<b>Prüfung: Klausur (120 Minuten)</b>		
<b>Prüfungsanforderungen:</b> Lorentzgruppe; relativistische Mechanik; Konzept der Raum-Zeit-Mannigfaltigkeit; Vierergroessen; Energie-Impuls-Tensor		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Arnulf Quadt StudiendekanIn der Fakultät für Physik	
<b>Angebotshäufigkeit:</b> unregelmäßig	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 5 - 6; Master: 1	
<b>Maximale Studierendenzahl:</b> nicht begrenzt		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5807: Physics of particle accelerators</b>		3 WLH
<b>Learning outcome, core skills:</b> After successful completion of this module, students should be familiar with the concepts, the physics (mainly electromagnetism) and explicit examples of historic and modern particle accelerators. Ideally, they should be able to simulate beam optics via numerical simulations (MatLab/SciLab).		<b>Workload:</b> Attendance time: 42 h Self-study time: 48 h
<b>Course: Physics of particle accelerator (Lecture)</b>		
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> Introduction to physics of particle accelerators; synchrotron radiation; linear beam optics; injection and ejection; high-frequency system for particle acceleration; radiation effects; luminosity, wigglers and undulators; modern particle accelerators based on the examples HERA, LEP, Tevatron, LHC, ILC and free electron laser FLASH/XFEL.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Nuclear/Particle Physics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Arnulf Quadt	
<b>Course frequency:</b> every 4th semester; unregular	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> not limited		

<b>Georg-August-Universität Göttingen</b>		3 C 3 WLH
<b>Module B.Phy.5808: Interactions between radiation and matter - detector physics</b>		
<b>Learning outcome, core skills:</b> After successful completion of this module, students should be familiar with a conceptual understanding of different particle detectors and the underlying interactions. They should be familiar with physics processes of particle or radiation detection in high energy physics and related fields and applications.		<b>Workload:</b> Attendance time: 42 h Self-study time: 48 h
<b>Course: Interactions between radiation and matter - detector physics (Lecture)</b>		
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> Mechanism of particle detection; interactions of charged particles and photons with matter; proportional and drift chambers; semiconductor detectors; microstrip and pixel detectors; Cherenkov detectors; transition radiation detectors; scintillation (organic crystals and plastic scintillators); electromagnetic calorimeter; hadron calorimeter.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Nuclear/Particle Physics	
<b>Language:</b> German	<b>Person responsible for module:</b> Prof. Dr. Arnulf Quadt	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> not limited		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5809: Hadron-Collider-Physics</b>		3 WLH
<b>Learning outcome, core skills:</b> Learning Objectives and Competencies: After successful completion of this module, students should be well-versed in the challenges and concepts of experimental physics at modern hadron colliders.		<b>Workload:</b> Attendance time: 42 h Self-study time: 48 h
<b>Course: Hadron-Collider-Physics (Lecture)</b>		
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> Introduction to particle physics; Kinematics at hadron colliders; historical overview and experimental features of hadron colliders such as PS, SPS, Tevatron, HERA, and LHC; Typical detectors and their functionalities for hadron collider physics; Structure of the proton and measurements thereof; Factorization theorem; Total and differential hadron cross sections; Diffraction; Soft underlying event, multiple interactions, and pile-up; QCD and Jet Physics; Angular correlations; Physics of vector bosons; Z-Asymmetry and W mass measurements; W charge asymmetry; W/Z cross sections; Physics of the top quark; Search for supersymmetric particles as candidates of dark matter; Searches for new physics in exotic models; Experimental methods for data analysis.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Nuclear and Particle Physics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Arnulf Quadt	
<b>Course frequency:</b> every 4th semester; irregular	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5810: Physics of the Higgs boson</b>		3 WLH
<b>Learning outcome, core skills:</b> After successful completion of this module, students should possess a deep understanding of the Higgs mechanism, the properties of the Higgs boson, and experimental methods (concepts and concrete examples) used in investigations of the Higgs sector.		<b>Workload:</b> Attendance time: 42 h Self-study time: 48 h
<b>Course: Physics of the Higgs boson (Lecture)</b>		
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> Review of the Standard Model of particle physics; The Higgs mechanism and the Higgs potential; properties of the Standard Model Higgs boson; Experimental methods in the search for the Higgs boson at LEP, Tevatron and LHC; Discovery of the Higgs boson; Measurement of the Higgs boson couplings and other properties; Two Higgs Doublet Modells and extended Higgs sectors (in particular, the MSSM); Searches for Higgs bosons beyond the Standard Model.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Nuclear/Particle Physics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Arnulf Quadt	
<b>Course frequency:</b> every 4th semester; irregular	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5811: Statistical methods in data analysis</b>		3 WLH
<b>Learning outcome, core skills:</b> After successful completion of this module, students should be well-versed in the theoretical foundations of statistical methodology used in data analysis. This is complemented with concrete examples where statistical analysis is performed using the ROOT software package (a free C++ type software package for data analysis, which runs on Linux, Windows, and Mac operating systems).		<b>Workload:</b> Attendance time: 42 h Self-study time: 48 h
<b>Course: Statistical methods in data analysis</b> (Lecture)		
<b>Examination: oral exam (approx. 30 min.) or written exam (120 min.)</b> <b>Examination requirements:</b> Concepts, methods, can concrete examples of statistical methods in data analysis: Introduction and description of data; theoretical probability density functions, including Gaussian, Poisson, and multi-dimensional distributions; parameter estimation; maximum likelihood method (and examples); $\chi^2$ method and $\chi^2$ -distribution; optimization; hypothesis tests; classification methods; Monte Carlo methods; unfolding.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Nuclear/Particle Physics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Arnulf Quadt	
<b>Course frequency:</b> irregular	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 30		



<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module B.Phy.5812: Physics of the top-quark</b>		3 WLH
<b>Learning outcome, core skills:</b> Learning Objectives and Competencies: After successful completion of this module, students should be familiar with the properties and interactions of the top-quark as well as the experimental methods for its studies.		<b>Workload:</b> Attendance time: 42 h Self-study time: 48 h
<b>Course: Physics of the top-quark (Lecture)</b>		
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> Concepts and specific experimental methods for the discovery and studies of the top-quark. Introduction to particle physics of quarks, discovery of the top-quark, top-antitop production (theory and experiment); electroweak production of single-top quarks; top-quark mass; electric charge and spin of top-quarks; W-helicity in top-quark decay; top-quark decay in the standard model and beyond; sensitivity to new physics; top-quark physics at the ILC, recent results of top-quark physics.		3 C
<b>Admission requirements:</b> keine	<b>Recommended previous knowledge:</b> Introduction to Nuclear/Particle Physics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Arnulf Quadt	
<b>Course frequency:</b> every 4th semester; irregular	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.5815: Seminar zu einführenden Themen der Teilchenphysik</b> <i>English title: Seminar on Introductory Topics in Particle Physics</i>		4 C 2 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden anhand von Publikationen oder Buchkapiteln sich in Fragestellungen zu Themen der modernen Elementarteilchenphysik einarbeiten und in einem Seminarvortrag vorstellen können.		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 92 Stunden
<b>Lehrveranstaltung: Seminar</b>		
<b>Prüfung: Vortrag (ca. 30 Min.) mit schriftlicher Ausarbeitung (max. 20 S.)</b> <b>Prüfungsvorleistungen:</b> Aktive Teilnahme <b>Prüfungsanforderungen:</b> Selbständige Erarbeitung wissenschaftlicher Sachverhalte und deren Präsentation.		4 C
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> Einführung in die Kern-/Teilchenphysik	
<b>Sprache:</b> Deutsch, Englisch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Arnulf Quadt	
<b>Angebotshäufigkeit:</b> jedes Sommersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> 5 - 6	
<b>Maximale Studierendenzahl:</b> 20		

<b>Georg-August-Universität Göttingen</b>		3 C 2 WLH
<b>Module B.Phy.5816: Phenomenology of Physics Beyond the Standard Model</b>		
<b>Learning outcome, core skills:</b> After successful completion of this module, students understand the shortcomings and limitations of the Standard Model of Particle Physics. Students also acquire insight into the phenomenology of physics beyond the Standard Model (BSM) at TeV energy scales, particularly from models with Supersymmetry and Extra dimensions. Students will also learn the experimental signatures of BSM phenomenology at colliders along with experimental techniques and statistical methods.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Phenomenology of Physics Beyond the Standard Model (Lecture)</b>		
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> Review of the Standard Model of particle physics; Limitations and Shortcomings of the Standard Model; Phenomenology of Supersymmetry; Phenomenology of Extra Dimensions; Other Models with New Physics; Collider Signatures of New Physics; Statistics for Experimental Searches		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Nuclear/Particle Physics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Stan Lai	
<b>Course frequency:</b> every 4th semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 5 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module B.Phy.5901: Advanced Algorithms for Computational Physics</b>		
<b>Learning outcome, core skills:</b> The goal of the module is to introduce advanced algorithms and program structures / design, enabling the students to write codes for more advanced tasks in computational physics from scratch (preferably in C++).		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Advanced Algorithms for Computational Physics</b>		
<b>Examination: Oral exam (approx.30 min.) or oral presentation with discussion (approx.30 min.), 2 weeks time for preparation) or project work at home with a final report (max. 15 pages)</b> <b>Examination requirements:</b> <ul style="list-style-type: none"> <li>• Implementation and usage of advanced algorithms to solve problems in computational physics</li> <li>• Understanding of the algorithms</li> <li>• Ability to choose suitable methods for solving a given problem</li> </ul> <b>Topics:</b> <ol style="list-style-type: none"> <li>1. „Design Patterns“: typical programming/design structures and strategies</li> <li>2. Algorithms for quantum problems, e.g., exact diagonalization approaches, numerical renormalization group and related methods, Quantum Monte Carlo</li> <li>3. Algorithms used in engineering, e.g., finite element methods</li> <li>4. Algorithms for and basics of computational finance</li> </ol>		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Programming course, course lecture „CWR“	
<b>Language:</b> English	<b>Person responsible for module:</b> StudiendekanIn der Fakultät für Physik	
<b>Course frequency:</b> irregular	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 6; Master: 1 - 4	
<b>Maximum number of students:</b> 40		
<b>Additional notes and regulations:</b>		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.5902: Physik für BundeskanzlerInnen, ManagerInnen und BürgerInnen</b> <i>English title: Physics for presidents and citizens</i>		3 C 2 SWS
<b>Lernziele/Kompetenzen:</b> <b>Lernziele:</b> Die Physik und Technik, die sich hinter Zeitungs-Schlagzeilen über weltweit wichtige Themen wie z.B. (i) Energie-Krise und erneuerbare Energien, (ii) Kernkraft militärisch und zivil, (iii) Raumfahrt, (iv) Globale Erwärmung, (v) neue Technologien verbirgt, wird in informeller, problembezogener Art und Weise so weit durchdrungen, dass Risiken und Nutzen von diskutierten Strategien und Technologien rational bewertet werden können.  <b>Kompetenzen:</b> Studierende sollen die Relevanz von physikalischen Fakten, Begriffen und Argumenten für strategische Entscheidungen über wichtige technologische und gesellschaftliche Fragen begreifen und zu rationaler Urteilsfindung über diese komplexen Probleme angeleitet werden.		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 62 Stunden
<b>Lehrveranstaltung: Physik für BundeskanzlerInnen, ManagerInnen und BürgerInnen (Vorlesung)</b>		
<b>Prüfung: Klausur (60 Minuten)</b> <b>Prüfungsanforderungen:</b> Anwendung physikalischer Begriffe, Konzepte und Argumente zur rationalen Begründung eines Urteils über Nachrichten über technologisch-gesellschaftlichen Fragen in Medien.		3 C
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Reiner Kree	
<b>Angebotshäufigkeit:</b> jährlich nach Bedarf WiSe oder SoSe	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 3 - 6; Master: 1 - 4	
<b>Maximale Studierendenzahl:</b> nicht begrenzt		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module B.Phy.606: Electronic Lab Course for Natural Scientists</b>		6 WLH
<b>Learning outcome, core skills:</b> Learning Objectives and Competencies: After successful completion of this module, students should be familiar with <ul style="list-style-type: none"> <li>• fundamental concepts and terminology of electronics</li> <li>• be able to handle modern electronic devices (simple devices, basic circuits)</li> <li>• be able to work out and conduct a scientific project within a given time window</li> </ul>		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Course: B.Phy.606. Electronic lab course for natural scientists</b> (Internship, Lecture, Exercise) 1. Lecture with excercises 2. Lab (5 Experiments) 3. Praktikum (1 Projekt)		
<b>Examination: Presentation with discussion (approx. 30 minutes) and written elaboration (max. 10 pages)</b> <b>Examination prerequisites:</b> At least 50% of problem sets (homework) have to be solved (passed) <b>Examination requirements:</b> <ol style="list-style-type: none"> <li>1. fundamental concepts and terminology of electronics,</li> <li>2. handling of simple electronics devices, basic circuits and functional units;</li> <li>3. conceptual design and realisation of projects in electronics.</li> </ol>		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Arnulf Quadt	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 4 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 20		
<b>Additional notes and regulations:</b> Block course		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.607: Akademisches Schreiben für Physiker/innen</b> <i>English title: Academic Writing for Physicists</i>		4 C 2 SWS
<b>Lernziele/Kompetenzen:</b> <b>Lernziele:</b> In diesem Workshop erlernen Studierende Grundkompetenzen des akademischen Schreibens in den beiden Schreibtraditionen des Deutschen und Englischen. Hierfür werden unterschiedliche Textarten (z.B. wissenschaftlicher Artikel, Essay, Protokoll, Bericht) sowie akademische Teiltexthe (z.B. Einleitung – Introduction) in den beiden Schreibtraditionen analysiert und miteinander verglichen. Von diesem analytisch-rezeptiven Ansatz ausgehend vertiefen die Studierenden ihre Kenntnisse, indem sie selbst akademische Texte in beiden Schreibtraditionen verfassen, hierbei wird ein Schwerpunkt auf das Schreiben englischer akademischer Texte gelegt. <b>Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden über akademische Schreibkompetenzen in englischer und deutscher Schreibtradition, Reflexionsvermögen eigener akademischer Schreibprozesse sowie Feedbackkompetenzen verfügen.		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 92 Stunden
<b>Lehrveranstaltung: Akademisches Schreiben für Physiker/innen</b>		
<b>Prüfung: Portfolio (max. 20 Seiten)</b> <b>Prüfungsvorleistungen:</b> Aktive, regelmäßige Teilnahme an dem Workshop, Erledigen schriftlicher Teilleistungen		
<b>Prüfungsanforderungen:</b> Verfassen deutscher und englischer wissenschaftlicher Texte		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> StudiendekanIn der Fakultät für Physik	
<b>Angebotshäufigkeit:</b> jedes Semester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 4 - 6; Master: 1 - 4	
<b>Maximale Studierendenzahl:</b> 20		

<b>Georg-August-Universität Göttingen</b> <b>Modul B.Phy.608: Scientific Literacy - Integration von Naturwissenschaften in die Gesellschaft und Politik</b> <i>English title: Scientific Literacy</i>		4 C 2 SWS
<b>Lernziele/Kompetenzen:</b> <b>Lernziele:</b> Dieses interdisziplinäre Modul soll die Kluft zwischen den Naturwissenschaften und den Geistes- und Gesellschaftswissenschaften überbrücken helfen. Die Studierenden aller Fachrichtungen sollen gemeinsam naturwissenschaftliche Erkenntniswege kennenlernen und sie anhand aktueller Themen (z.B. anthropogener Klimawandel) nachvollziehen. Hierzu werden auch Grundlagen der Wissenschaftstheorie vermittelt. <b>Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten Studierende ein Verständnis für Scientific Literacy (u.a. wissenschaftliche Nachprüfbarkeit, Unterscheidung zwischen naturwissenschaftlichen, politischen und gesellschaftlichen Komponenten einer Bewertung) entwickelt sowie Vermittlungskompetenz erworben haben.		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 92 Stunden
<b>Lehrveranstaltung: Seminar</b>		
<b>Prüfung: Portfolio (max. 10 Seiten)</b> <b>Prüfungsvorleistungen:</b> Vortrag (ca. 30 Minuten) oder äquivalente Leistung sowie aktive Teilnahme <b>Prüfungsanforderungen:</b> Grundlagen der Wissenschaftstheorie; Unterscheidung zwischen naturwissenschaftlichen, politischen und gesellschaftlichen Komponenten einer Bewertung.		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> StudiendekanIn der Fakultät für Physik	
<b>Angebotshäufigkeit:</b> unregelmäßig	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Bachelor: 3 - 6; Master: 1 - 4	
<b>Maximale Studierendenzahl:</b> 24		



<b>Georg-August-Universität Göttingen</b> <b>Module B.SK-Phy.9001: Papers, Proposals, Presentations: Skills of Scientific Communication</b>		4 C 2 WLH
<b>Learning outcome, core skills:</b> Goals: Handling of different presentation media (written and oral); presenting complex facts to experts and laymen; skills of communication and scientific discussion		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Papers, Proposals, Presentations: Skills of Scientific Communication</b> (Seminar)		2 WLH
<b>Examination: Lecture (approx. 30 minutes)</b> <b>Examination prerequisites:</b> Active participation <b>Examination requirements:</b> Independent preparation and scientific publications and their presentation Time for preparation 4 weeks		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Ansgar Reiners	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Bachelor: 4 - 6; Master: 1 - 4	
<b>Maximum number of students:</b> 18		
<b>Additional notes and regulations:</b> Einbringbar in den Wahlbereich nicht-physikalisch.		

<b>Georg-August-Universität Göttingen</b> <b>Modul M.Che.1314: Biophysikalische Chemie</b> <i>English title: Biophysical Chemistry</i>		6 C 4 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Abschluss des Moduls ... <ul style="list-style-type: none"> <li>• sollen die Studierenden in der Lage sein, die wesentlichen physikochemischen Zusammenhänge biologischer Materie zu verstehen</li> <li>• die generellen Triebkräfte biologischer Reaktionen kennen</li> <li>• Spektroskopische Methoden zur Strukturbestimmung biologischer Makromoleküle verstehen und anwenden können</li> <li>• die Grundzüge moderner optischer Mikroskopie sowie der Sondenmikroskopie verstanden haben</li> <li>• die Mechanik und Dynamik biologischer Systeme ausgehend vom Einzelmolekül bis zur einzelnen Zelle erörtern können</li> </ul>		<b>Arbeitsaufwand:</b> Präsenzzeit: 56 Stunden Selbststudium: 124 Stunden
<b>Lehrveranstaltung: Vorlesung mit Übungen Biophysikalische Chemie</b>		4 SWS
<b>Prüfung: Klausur (120 Minuten)</b>		6 C
<b>Prüfungsanforderungen:</b> <ul style="list-style-type: none"> <li>• Strukturen biologischer Makromoleküle aus spektroskopischen und mikroskopischen Daten ableiten können</li> <li>• Übertragung genereller physikochemischer Prinzipien, wie zum Beispiel der Reaktionsdynamik, (statistischen) Thermodynamik und Quantentheorie auf die Beschreibung biologischer Phänomene</li> <li>• Kenntnisse der wesentlichen Methoden, wie z.B. Streumethoden, spektroskopische Methoden (UV-Vis, Fluoreszenz, Lumineszenz, Circular dichroismus ATR-IR, NMR, ESR, ...), kalorimetrischen und kolligativen Methoden</li> </ul>		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> keine	
<b>Sprache:</b> Deutsch, Englisch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Andreas Janshoff	
<b>Angebotshäufigkeit:</b> jedes Sommersemester	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> 1 - 2	
<b>Maximale Studierendenzahl:</b> 64		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module M.Phy-AM.001: Active Galactic Nuclei</b>		2 WLH
<b>Learning outcome, core skills:</b> <b>Learning outcome:</b> Observational properties of active galaxies, taxonomy of AGN, continuum and emission line physics, structure and cinematics of the central region, supermassive black holes, unified models, environment, evolution of AGN. <b>Core skills:</b> After successful completion of the modul students should be able to describe and explain spectroscopy and physical properties of active galaxies.		<b>Workload:</b> Attendance time: 28 h Self-study time: 152 h
<b>Course: Lecture with exercises</b>		
<b>Examination: Oral Exam (ca. 30 Min.)</b>		6 C
<b>Examination requirements:</b> Classification, spectral properties and physics of the central region in active galaxies surrounding the central supermassive black hole, properties of the hostgalaxies, large scale environment, evolution of AGN.		
<b>Admission requirements:</b> Previous AstroMundus courses (1.+2. Sem.)	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Wolfram Kollatschny	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> 3	
<b>Maximum number of students:</b> 15		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module M.Phy-AM.002: Stellar structure and evolution</b>		2 WLH
<p><b>Learning outcome, core skills:</b>  <b>Learning outcome:</b> The physics of stellar interiors and the evolution of stars belong to the fundamentals of astrophysics. The following topics will be studied in detail: Equations of stellar structure - Energy transport by diffusion of radiation, convection, and conduction - Equation of state, opacity and nuclear energy generation - Methods for the solution of the equations of stellar structure - Simple stellar models (polytropes) and their application - Stellar evolution: Pre - main sequence evolution, main sequence phase, post - main sequence evolution, final stages of stellar evolution..</p> <p><b>Core skills:</b> After successful completion of the modul students should be able to describe and explain the fundamentals of stellar structure and evolution, application of the concepts and results of the subject to other areas of astrophysics</p>		<p><b>Workload:</b>  Attendance time: 28 h  Self-study time: 152 h</p>
<b>Course: Lecture</b>		
<p><b>Examination: Oral Exam (ca. 30 Min.)</b>  <b>Examination prerequisites:</b>  Solution of exercises</p>		6 C
<p><b>Examination requirements:</b>  Knowledge of the physics of stellar structure and evolution, the mechanics and thermodynamics of stellar structure, the methods for the solution of the equations of stellar structure, the various stages of stellar evolution and their interpretation.</p>		
<p><b>Admission requirements:</b>  Previous AstroMundus courses (1.+2. Sem.)</p>	<p><b>Recommended previous knowledge:</b>  none</p>	
<p><b>Language:</b>  English</p>	<p><b>Person responsible for module:</b>  Prof. Dr. Wolfram Kollatschny</p>	
<p><b>Course frequency:</b>  each winter semester</p>	<p><b>Duration:</b>  1 semester[s]</p>	
<p><b>Number of repeat examinations permitted:</b>  twice</p>	<p><b>Recommended semester:</b>  3</p>	
<p><b>Maximum number of students:</b>  15</p>		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module M.Phy-AM.003: Stellar Atmospheres</b>		4 WLH
<b>Learning outcome, core skills:</b> <b>Learning outcome:</b> Understanding of interaction of radiation and matter, radiative transfer, structure of stellar atmospheres; thorough understanding of the theoretical foundations of spectral analysis. <b>Core skills:</b> Application of physical concepts (such as atomic and molecular physics, thermodynamics, and statistical physics) in an astrophysical context, and their implementation in numerical simulations.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Courses:</b> <b>1. Physics of stellar atmospheres</b> <b>2. Stellar atmosphere modelling</b>		2 WLH 2 WLH
<b>Examination: Oral Exam (ca. 30 Min.)</b> <b>Examination prerequisites:</b> Successful work on the assignments in both courses.		6 C
<b>Examination requirements:</b> Oral account of the context and concepts learned during the two courses on the topics of interaction of radiation and matter, radiative transfer, structure of stellar atmospheres, and theoretical foundations of spectral analysis; answering of specific questions on all the aspects in this field.		
<b>Admission requirements:</b> Previous AstroMundus courses (1.+2. Sem.)	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Wolfram Kollatschny	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> 3	
<b>Maximum number of students:</b> 10		

<b>Georg-August-Universität Göttingen</b> <b>Module M.Phy-AM.012: Astrophysical Properties: From planets to cosmology</b>	12 C 8 WLH
<b>Learning outcome, core skills:</b> After successful completion of the modul the students should have competence in different fields of observational as well as theoretical astrophysics. The topics of these lectures range from the nearby universe covering the Sun, Space Weather, helioseismology and planets up to more distant stars. Another subject is the physics and evolution of galaxies including their central supermassive Black Holes. Finally, aspects of the evolution of the universe (cosmology) will be addressed.	<b>Workload:</b> Attendance time: 112 h Self-study time: 248 h
<b>Course: students choose 4 courses of the following contents</b> <i>Contents:</i> - Cosmology, Early Universe, String theory - Galaxies, Supermassive Black Holes, Interstellar Medium - Stars, Planets - Solar Physics, (Helio)seismology, Space Weather - Observational Astrophysics - Numerical Experiments in Astrophysics	
<b>Examination: Oral examination (approx. 60 minutes)</b> <b>Examination requirements:</b> The basic physical principals that have been taught in the individual lectures have to be understood in the context of the astrophysical relevance. This includes competence in numerical methods for the lecture on numerical experiments in astrophysics.	12 C
<b>Admission requirements:</b> 1st year AstroMundus courses	<b>Recommended previous knowledge:</b> none
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Wolfram Kollatschny
<b>Course frequency:</b> once a year	<b>Duration:</b> 1 semester[s]
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> 3
<b>Maximum number of students:</b> 15	

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module M.Phy.1401: Advanced Lab Course I</b>		6 WLH
<b>Learning outcome, core skills:</b> After successful completion of the module, students have <ul style="list-style-type: none"> <li>• familiarised themselves independently with complex issues,</li> <li>• performed experimental tasks under guidance in a team,</li> <li>• and have written scientific protocols within good scientific practice.</li> </ul>		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Course: Advanced Lab Course I</b>		
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination prerequisites:</b> 4 successful performed experiments. <b>Examination requirements:</b> Advanced experimental methods for solving physical problems.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> StudiendekanIn der Fakultät für Physik	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1	
<b>Maximum number of students:</b> not limited		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module M.Phy.1402: Advanced Lab Course II</b>		6 WLH
<b>Learning outcome, core skills:</b> After successful completion of the module, students have <ul style="list-style-type: none"> <li>• familiarised themselves independently with complex issues,</li> <li>• performed experimental tasks under guidance in a team,</li> <li>• and have written scientific protocols within good scientific practice.</li> </ul>		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Course: Advanced Lab Course II</b>		
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination prerequisites:</b> 4 successful performed experiments <b>Examination requirements:</b> Advanced experimental methods for solving physical problems.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> StudiendekanIn der Fakultät für Physik	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 2	
<b>Maximum number of students:</b> not limited		



<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module M.Phy.1403: Internship</b>		6 WLH
<b>Learning outcome, core skills:</b> After successful completion of the module, students should familiarise oneself independently in complex issues and perform tasks under guidance in team work. The students should be able to present the obtained results in a talk or as a poster.		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Course: Internship</b>		
<b>Examination: Posterpresentation (approx. 30 min.)</b> <b>Examination prerequisites:</b> Internship <b>Examination requirements:</b> Advanced methods for solving physical problems in the area of the chosen focus.		6 C
<b>Admission requirements:</b> This module can be selected only on the recommendation of a lecturer.	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> StudiendekanIn der Fakultät für Physik	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 2	

<b>Georg-August-Universität Göttingen</b>		9 C
<b>Module M.Phy.1601: Development and Realization of Scientific Projects in Astro-/Geophysics</b>		
<b>Learning outcome, core skills:</b> After successful completion of the module, students should be able to carry out the planning and the "controlling" of scientific research projects independently.  They should ... <ul style="list-style-type: none"> <li>• be able to use Literature Databases systematically;</li> <li>• have a good command of modern word processors;</li> <li>• have skills in good scientific practice.</li> </ul>		<b>Workload:</b> Attendance time: 0 h Self-study time: 270 h
<b>Course: Development and Realization of Scientific Projects in Astro-/Geophysics</b>		
<b>Examination: written report (max. 30 S.)</b>		9 C
<b>Examination requirements:</b> Use of Literature Databases, good command of modern word processors		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies of the Faculty of Physics	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 3 - 4	
<b>Maximum number of students:</b> 150		

<b>Georg-August-Universität Göttingen</b>		9 C
<b>Module M.Phy.1602: Development and Realization of Scientific Projects in Biophysics/Complex Systems</b>		
<b>Learning outcome, core skills:</b> After successful completion of the module, students should be able to carry out the planning and the "controlling" of scientific research projects independently.  They should ... <ul style="list-style-type: none"> <li>• be able to use Literature Databases systematically;</li> <li>• have a good command of modern word processors;</li> <li>• have skills in good scientific practice.</li> </ul>		<b>Workload:</b> Attendance time: 0 h Self-study time: 270 h
<b>Course: Development and Realization of Scientific Projects in Biophysics/Complex Systems</b>		
<b>Examination: written report (max. 30 S.)</b>		9 C
<b>Examination requirements:</b> Use of Literature Databases, good command of modern word processors		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies of the Faculty of Physics	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 3 - 4	
<b>Maximum number of students:</b> 150		

<b>Georg-August-Universität Göttingen</b>		9 C
<b>Module M.Phy.1603: Development and Realization of Scientific Projects in Solid State/Materials Physics</b>		
<b>Learning outcome, core skills:</b> After successful completion of the module, students should be able to carry out the planning and the "controlling" of scientific research projects independently.  They should ... <ul style="list-style-type: none"> <li>• be able to use Literature Databases systematically;</li> <li>• have a good command of modern word processors;</li> <li>• have skills in good scientific practice.</li> </ul>		<b>Workload:</b> Attendance time: 0 h Self-study time: 270 h
<b>Course: Development and Realization of Scientific Projects in Solid State/Materials Physics</b>		
<b>Examination: written report (max. 30 S.)</b>		9 C
<b>Examination requirements:</b> Use of Literature Databases, good command of modern word processors		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies of the Faculty of Physics	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 3 - 4	
<b>Maximum number of students:</b> 150		

<b>Georg-August-Universität Göttingen</b> <b>Module M.Phy.1604: Development and Realization of Scientific Projects in Nuclear/Particle Physics</b>		9 C
<b>Learning outcome, core skills:</b> After successful completion of the module, students should be able to carry out the planning and the "controlling" of scientific research projects independently.  They should ... <ul style="list-style-type: none"> <li>• be able to use Literature Databases systematically;</li> <li>• have a good command of modern word processors;</li> <li>• have skills in good scientific practice.</li> </ul>		<b>Workload:</b> Attendance time: 0 h Self-study time: 270 h
<b>Course: Development and Realization of Scientific Projects in Nuclear/Particle Physics</b>		
<b>Examination: written report (max. 30 S.)</b>		9 C
<b>Examination requirements:</b> Use of Literature Databases, good command of modern word processors		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies of the Faculty of Physics	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 3 - 4	
<b>Maximum number of students:</b> 150		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module M.Phy.1605: Networking in Astro-/Geophysics</b>		
<b>Learning outcome, core skills:</b> <b>Objectives:</b> Formulation of proposals, registration, funding and participation in congresses <b>Competences:</b> After successful completion of the module the student should have gained networking skills.		<b>Workload:</b> Attendance time: 0 h Self-study time: 90 h
<b>Course: Networking in Astro-/Geophysics</b>		
<b>Examination: written report (max. 10 S.), not graded</b>		3 C
<b>Examination requirements:</b> Networking and application in scientific and professional environment on student's own initiative.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Studiendekan/in der Fakultät für Physik	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 3 - 4	
<b>Maximum number of students:</b> 150		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module M.Phy.1606: Networking in Biophysics/Physics of Complex Systems</b>		
<b>Learning outcome, core skills:</b> <b>Objectives:</b> Formulation of proposals, registration, funding and participation in congresses <b>Competences:</b> After successful completion of the module the student should have gained networking skills.		<b>Workload:</b> Attendance time: 0 h Self-study time: 90 h
<b>Course: Networking in Biophysics/Physics of Complex Systems</b>		
<b>Examination: written report (max. 10 S.), not graded</b>		3 C
<b>Examination requirements:</b> Networking and application in scientific and professional environment on student's own initiative.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Studiendekan/in der Fakultät für Physik	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 3 - 4	
<b>Maximum number of students:</b> 150		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module M.Phy.1607: Networking in Solid State/Materials Physics</b>		
<b>Learning outcome, core skills:</b> <b>Objectives:</b> Formulation of proposals, registration, funding and participation in congresses <b>Competences:</b> After successful completion of the module the student should have gained networking skills.		<b>Workload:</b> Attendance time: 0 h Self-study time: 90 h
<b>Course: Networking in Solid State/Materials Physics</b>		
<b>Examination: written report (max. 10 S.), not graded</b>		3 C
<b>Examination requirements:</b> Networking and application in scientific and professional environment on student's own initiative.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Studiendekan/in der Fakultät für Physik	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 3 - 4	
<b>Maximum number of students:</b> 150		



<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module M.Phy.1608: Networking in Nuclear/Particle Physics</b>		
<b>Learning outcome, core skills:</b> <b>Objectives:</b> Formulation of proposals, registration, funding and participation in congresses <b>Competences:</b> After successful completion of the module the student should have gained networking skills.		<b>Workload:</b> Attendance time: 0 h Self-study time: 90 h
<b>Course: Networking in Nuclear/Particle Physics</b>		
<b>Examination: written report (max. 10 S.), not graded</b>		3 C
<b>Examination requirements:</b> Networking and application in scientific and professional environment on student's own initiative.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Studiendekan/in der Fakultät für Physik	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 3 - 4	
<b>Maximum number of students:</b> 150		

<b>Georg-August-Universität Göttingen</b>		18 C
<b>Module M.Phy.405: Research Lab Course in Astro- and Geophysics</b>		
<b>Learning outcome, core skills:</b> <b>Learning Outcome:</b> By working independently within a current scientific research project students are fostered to familiarize themselves with a new advanced topic in the field of Astro-/Geophysics. They will learn to successfully perform a sub-task and finally present the results to a professional audience.  <b>Core skills:</b> Students will be able to organize, conduct, evaluate and present small, manageable projects in the field of Astro-/Geophysics, obeying the rules of good scientific practice.		<b>Workload:</b> Attendance time: 0 h Self-study time: 540 h
<b>Course: Research Lab Course in Astro- and Geophysics</b>		
<b>Examination: Lecture, (2 weeks preparation time) (approx. 30 minutes)</b> <b>Examination requirements:</b> Methods for in-depth familiarisation in a scientific field of work, critical review of literature, scientific presentation, good scientific practice.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Alle Dean of Studies of the Faculty of Physics	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> 3 - 4	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		18 C
<b>Module M.Phy.406: Research Lab Course in Biophysics and Physics of Complex Systems</b>		
<b>Learning outcome, core skills:</b> <b>Learning Outcome:</b> By working independently within a current scientific research project students are fostered to familiarize themselves with a new advanced topic in the field of Biophysics/Complex Systems. They will learn to successfully perform a sub-task and finally present the results to a professional audience.  <b>Core skills:</b> Students will be able to organize, conduct, evaluate and present small, manageable projects in the field of Biophysics/Complex Systems, obeying the rules of good scientific practice.		<b>Workload:</b> Attendance time: 0 h Self-study time: 540 h
<b>Course: Research Lab Course in Biophysics and Physics of Complex Systems</b>		
<b>Examination: Lecture, (2 weeks preparation time) (approx. 30 minutes)</b> <b>Examination requirements:</b> Methods for in-depth familiarisation in a scientific field of work, critical review of literature, scientific presentation, good scientific practice.		18 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Alle Dean of Studies of the Faculty of Physics	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> 3 - 4	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		18 C
<b>Module M.Phy.407: Research Lab Course in Solid State/Materials Physics</b>		
<b>Learning outcome, core skills:</b> <b>Learning Outcome:</b> By working independently within a current scientific research project students are fostered to familiarize themselves with a new advanced topic in the field of Solid State/Materials Physics. They will learn to successfully perform a sub-task and finally present the results to a professional audience. <b>Core skills:</b> Students will be able to organize, conduct, evaluate and present small, manageable projects in the field of Solid State/Materials Physics, obeying the rules of good scientific practice.		<b>Workload:</b> Attendance time: 0 h Self-study time: 540 h
<b>Course: Research Lab Course in Solid State/Materials Physics</b>		
<b>Examination: Lecture, (2 weeks preparation time) (approx. 30 minutes)</b> <b>Examination requirements:</b> Methods for in-depth familiarisation in a scientific field of work, critical review of literature, scientific presentation, good scientific practice.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies of the Faculty of Physics	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> 3 - 4	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		18 C
<b>Module M.Phy.408: Research Lab Course in Nuclear and Particle Physics</b>		
<b>Learning outcome, core skills:</b> <b>Learning Outcome:</b> By working independently within a current scientific research project students are fostered to familiarize themselves with a new advanced topic in the field of Course in Nuclear and Particle Physics. They will learn to successfully perform a sub-task and finally present the results to a professional audience. <b>Core skills:</b> Students will be able to organize, conduct, evaluate and present small, manageable projects in the field of Nuclear and Particle Physics, obeying the rules of good scientific practice.		<b>Workload:</b> Attendance time: 0 h Self-study time: 540 h
<b>Course: Research Lab Course in Particle Physics</b>		
<b>Examination: Lecture, (2 weeks preparation time) (approx. 30 minutes)</b> <b>Examination requirements:</b> Methods for in-depth familiarisation in a scientific field of work, critical review of literature, scientific presentation, good scientific practice.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies of the Faculty of Physics	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> 3 - 4	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module M.Phy.409: Research Seminar Astro-/Geophysics</b>		2 WLH
<b>Learning outcome, core skills:</b> After successful completion of the module, students should present complex lines of reasoning and evaluate own and others' presentations in critical discussion.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Research Seminar Astro-/Geophysics</b>		
<b>Examination: Lecture, (4 weeks preparation time) (approx. 60 minutes)</b> <b>Examination requirements:</b> Preparation of complex topics for presentation and scientific discussions.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies of the Faculty of Physics	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> 1 - 2	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		4 C 2 WLH
<b>Module M.Phys.410: Research Seminar Biophysics/Physics of Complex Systems</b>		
<b>Learning outcome, core skills:</b> After successful completion of the module, students should present complex lines of reasoning and evaluate own and others' presentations in critical discussion.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Research Seminar Biophysics/Physics of Complex Systems</b>		
<b>Examination: Lecture, (4 weeks preparation time) (approx. 60 minutes)</b> <b>Examination prerequisites:</b> active participation <b>Examination requirements:</b> Preparation of complex topics for presentation and scientific discussions.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies of the Faculty of Physics	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> 1 - 2	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		4 C 2 WLH
<b>Module M.Phy.411: Research Seminar Solid State/Materials Physics</b>		
<b>Learning outcome, core skills:</b> After successful completion of the module, students should present complex lines of reasoning and evaluate own and others' presentations in critical discussion.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Research Seminar Solid State/Materials Physics</b>		
<b>Examination: Lecture, (4 weeks preparation time) (approx. 60 minutes)</b> <b>Examination prerequisites:</b> active participation <b>Examination requirements:</b> Preparation of complex topics for presentation and scientific discussions.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies of the Faculty of Physics	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> 1 - 2	
<b>Maximum number of students:</b> 40		



<b>Georg-August-Universität Göttingen</b>		4 C 2 WLH
<b>Module M.Phy.412: Research Seminar Particle Physics</b>		
<b>Learning outcome, core skills:</b> After successful completion of the module, students should present complex lines of reasoning and evaluate own and others' presentations in critical discussion.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Research Seminar Particle Physics</b>		
<b>Examination: Lecture, (4 weeks preparation time) (approx. 60 minutes)</b> <b>Examination prerequisites:</b> active participation <b>Examination requirements:</b> Preparation of complex topics for presentation and scientific discussions.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies of the Faculty of Physics	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> 1 - 2	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module M.Phy.413: General Seminar</b>		2 WLH
<b>Learning outcome, core skills:</b> After successful completion of the module, students should be able to develop the content of scientific publications (usually in English) independently and present it to a wide audience. They should be also able to evaluate it critically.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: General Seminar</b>		
<b>Examination: Lecture, (4 weeks preparation time) (approx. 60 minutes)</b> <b>Examination prerequisites:</b> active participation <b>Examination requirements:</b> Use of presentation media, presentation of complex issues in front of expert and non-expert audiences, communication and discussion skills, critical awareness and expressiveness.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies of the Faculty of Physics	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> 1 - 2	
<b>Maximum number of students:</b> 150		
<b>Additional notes and regulations:</b> We recomend to chose the seminar not of the own research focus.		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module M.Phy.5002: Contemporary Physics</b>		2 WLH
<b>Learning outcome, core skills:</b> <b>Lernziele:</b> To understand cutting-edge research in 6 topics in physics by attending the physics colloquia. Introductory lectures will be provided to bridge the gap between students lectures and the scientific level of the colloquium. <b>Kompetenzen:</b> After successful completion of modul students should be able to... <ul style="list-style-type: none"> <li>• independent learning;</li> <li>• independent analysis;</li> <li>• work in teams;</li> <li>• write scientific reports;</li> <li>• read scientific literature;</li> <li>• extract the important research questions and results from the physics colloquia.</li> </ul>		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Contemporary Physics</b>		2 WLH
<b>Examination: written report (max. 5 pages)</b> <b>Examination requirements:</b> Ability to combine the information given in the introductory lecture, the physics colloquium and current literature in 6 written reports on each of the colloquium topics.		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> StudiendekanIn der Fakultät für Physik	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 4	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Modul M.Phys.5501: Kompressible Strömungen</b>		2 SWS
<b>Lernziele/Kompetenzen:</b> <b>Lernziele:</b> Wellengleichung, Charakteristiken, Machsche Wellen, Prandtl-Meyer Expansion, Verdichtungsstöße (Rankine-Hugoniot Relation, Stoßpolaren), Wirbelsatz von Crocco, Detonation und Deflagration <b>Kompetenzen:</b> Fähigkeit, grundlegende Effekte in kompressiblen Strömungen zu erkennen und erklären.		<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 62 Stunden
<b>Lehrveranstaltung: Vorlesung</b> (Vorlesung)		2 SWS
<b>Prüfung: Klausur (120 Min.) oder mündliche Prüfung (ca. 30 Min.)</b>		3 C
<b>Prüfungsanforderungen:</b> Erläuterung elementarer strömungsmechanischer Vorgänge in kompressiblen Strömungen		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> Grundkenntnisse der Strömungsmechanik	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Andreas Tilgner	
<b>Angebotshäufigkeit:</b> unregelmäßig (im Wintersemester)	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Master: 1 - 3	
<b>Maximale Studierendenzahl:</b> 30		

<b>Georg-August-Universität Göttingen</b>		3 C 2 WLH
<b>Module M.Phy.5502: Numerical experiments in stellar astrophysics</b>		
<b>Learning outcome, core skills:</b> After successful completion of the modul students should have hands-on experience in computing stellar models and solving oscillation eigenvalue problems.		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Numerical experiments in stellar astrophysics (Lecture)</b>		
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> <ul style="list-style-type: none"> <li>• Use of numerical codes to model the internal structure and oscillations of stars.</li> <li>• Hands-on experience with the codes.</li> <li>• Computation of stellar models and their oscillation frequencies.</li> <li>• Experimenting with parameters and physical inputs.</li> </ul>		3 C
<b>Admission requirements:</b> keine	<b>Recommended previous knowledge:</b> keine	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Laurent Gizon	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Master: 2 - 4	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b> <b>Modul M.Phys.5505: Erforschung des Sonnensystems durch Raummissionen</b> <i>English title: Solar System Exploration through Space Missions</i>		3 C 2 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls verfügen die Studierenden über Grundkenntnissen über: <ul style="list-style-type: none"> <li>• die kleinen Körper des Sonnensystems, insbesondere Kometen, Asteroiden und Trans-Neptun Objekte.</li> <li>• Aufbau, Planung, Durchführung einer wissenschaftlichen Weltraummission (Wissenschaftliche Zielsetzung, Raumsonde, wissenschaftliche Nutzlast, Missionsprofil/Analyse)</li> </ul>	<b>Arbeitsaufwand:</b> Präsenzzeit: 28 Stunden Selbststudium: 62 Stunden	
<b>Lehrveranstaltung: Erforschung des Sonnensystems durch Raummissionen</b> (Vorlesung) <i>Inhalte:</i> Anhand konkreter Beispiele wird die Planung und Durchführung unterschiedlicher Raummissionen zur Erforschung eines kleinen Körpers unseres Sonnensystems mit der wissenschaftlichen Zielsetzung, Einblicke in die Entstehung des Sonnensystems zu erhalten, erörtert.  Eigene Entwicklung eines Missionsprofils mit den folgenden Schwerpunkten ist zu erstellen: Auswahl des Zielobjekts, Missionsart und Missionsdauer, durchzuführende Messungen und vorgeschlagene Instrumente.		
<b>Prüfung: Mündlich (ca. 30 Minuten)</b> <b>Prüfungsanforderungen:</b> Für vorgegebene wissenschaftliche Ziele, soll ein Missionsvorschlag konzipiert werden, wobei insbesondere detailliert erläutert werden muss, wie die Mission die wissenschaftlichen Ziele erreichen kann (Missionsart, Technische Grundlagen, Messinstrumente) und wie die programmatischen und technischen Anforderungen erfüllt werden können.  Ferner soll eine Risikoanalyse durchgeführt werden. Der Vorschlag muss in einem 15-minütigen Vortrag kurz vorgestellt werden und wird dann im Prüfungsgespräch analysiert.		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> Hintergrundwissen in <ol style="list-style-type: none"> <li>1) Aufbau und Dynamik des Sonnensystems</li> <li>2) Spektroskopische Beobachtungsmethoden</li> <li>3) Massenspektroskopie</li> </ol>	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> Prof. Dr. Wolfram Kollatschny	

<b>Angebotshäufigkeit:</b> jedes Sommersemester1	<b>Dauer:</b> 1 Semester
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> ab 2
<b>Maximale Studierendenzahl:</b> 20	
<b>Bemerkungen:</b> Schwerpunkt Astro-/Geophysik	

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module M.Phy.551: Advanced Topics in Astro-/Geophysics I</b>		6 WLH
<b>Learning outcome, core skills:</b> <b>Learning outcome:</b> After successful completion of the modul students will be able to understand and apply advanced concepts of astro- and geophysics to current research topics. <b>Core skills:</b> Students will be able to describe and discuss state-of-the-art problems of astro-/geophysics.		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Course: Course (6 C) in the field of Astro- or Geophysics</b>		
<b>Examination: Written exam (120 min) or oral exam (ca. 30 min) or talk ( ca. 30 min), 2 weeks preparation time</b> <b>Examination requirements:</b> Advanced experimental techniques or theoretical models in astro- or geophysics		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies of the Faculty of Physics	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 4	
<b>Maximum number of students:</b> 40		



<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Phy.552: Advanced Topics in Astro-/Geophysics II</b>		
<b>Learning outcome, core skills:</b> After successful completion of the modul students should be familiar with advanced concepts of astrophysics and Geophysics.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Advanced Topics in Astro-/Geophysics IIa</b>		2 WLH
<b>Examination: Written examination (120 Min.) or oral examination (approx. 30 Min.) or talk (approx. 30 Min.), 2 weeks preparation time</b> <b>Examination requirements:</b> Advanced experimental techniques or theoretical models in astro- or geophysics		3 C
<b>Course: Advanced Topics in Astro-/Geophysics IIb</b>		2 WLH
<b>Examination: Written examination (120 Min.) or oral examination (approx. 30 Min.) or talk (approx. 30 Min.), 2 weeks preparation time</b> <b>Examination requirements:</b> Advanced experimental techniques or theoretical models in astro- or geophysics		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> German, English	<b>Person responsible for module:</b> StudiendekanIn der Fakultät für Physik	
<b>Course frequency:</b> each semester	<b>Duration:</b> 2 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 4	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module M.Phy.556: Seminar Advanced Topics in Astro-/Geophysics</b>		2 WLH
<b>Learning outcome, core skills:</b> After successful completion of the modul students should be familiar with the presentation of complex problems, scientific discussion as well as evaluation of contents of the presentations.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Seminar Advanced Topics in Astro-/Geophysics I</b>		
<b>Examination: Lecture, 4 weeks preparation time (approx. 60 minutes)</b> <b>Examination prerequisites:</b> active Participation <b>Examination requirements:</b> Advanced experimental techniques or theoretical models in astro- or geophysics		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Stefan Dreizler	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> 1 - 2	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module M.Phys.5601: Seminar Computational Neuroscience/Neuroinformatics</b>		2 WLH
<b>Learning outcome, core skills:</b> After successful completion of the module, students ... <ul style="list-style-type: none"> <li>• have deepened their knowledge of computational neuroscience / neuroinformatics by an independent elaboration of a topic;</li> <li>• have learned methods of presentation of topics from computer science;</li> <li>• are able to deal with (English-language) literature;</li> <li>• are able to present an informatic topic;</li> <li>• are able to lead a scientific discussion.</li> </ul>		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Seminar</b> (Seminar) <i>Course frequency:</i> each semester		
<b>Examination: Presentation (approx. 45 Min.) with written report (max. 7 S.)</b> <b>Examination prerequisites:</b> regular participation <b>Examination requirements:</b> Independent preparation and presentation of research-related topics from the area of computational neuroscience / neuroinformatics as well as biophysics of neuronal systems.		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> B.Phys.5614	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Florentin Andreas Wörgötter	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> Master: 1 - 3	
<b>Maximum number of students:</b> 14		

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Phy.5604: Biomedicine imaging physics and medical physics</b>		
<b>Learning outcome, core skills:</b> After taking this course, students will have quantitative insight into the physical, mathematical and algorithmic foundations of imaging techniques for biomedical applications, in particular CT, MRI, tomographic reconstruction, image processing, nuclear techniques, ultrasound and laser-tissue interaction up to emerging techniques such as phase contrast radiography. Further, the course leads a basic understanding of medical physics in a broader sense, including radiotherapy, radiobiology.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Vorlesung</b> (Lecture)		
<b>Examination: Written examination (120 Min.) or oral examination (approx. 30 Min.) or Presentation (approx. 30 Min., 2 weeks preparation time)</b> <b>Examination requirements:</b> Knowledge of physical principles in medical diagnostics and therapy, in particular modern imaging techniques: Radiography (Absorptions- and Phase contrast), tomography, magnetic resonance imaging ( ) positron-emissions-tomography, single photon emission tomography (SPECT), nuclear methods and probes, ultrasound imaging, optical microscopy. Along with the experimental principles, the algorithmic and mathematical concepts of image reconstruction and processing have to be mastered.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Tim Salditt	
<b>Course frequency:</b> every 4th semester; alle 2 Jahre	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Master: 2 - 4	
<b>Maximum number of students:</b> 50		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module M.Phys.5608: Liquid State Physics</b>		2 WLH
<b>Learning outcome, core skills:</b> Lernziele/Kompetenzen: Students should learn the core concepts of the theories and experimental phenomenology of the liquid state, from simple to macromolecular/polymeric to granular liquids. Through readings of the important papers, both seminal or at the fore-front of research, they should learn how to understand the modern open questions regarding the liquid state. Students should also explore a specific topic that is currently subject of active research, and prepare an oral presentation and a written handout at the end of the semester.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Liquid State Physics</b> <i>Contents:</i> This course will cover the foundations of the theoretical and experimental description of simple liquids, macromolecular/polymeric liquids and granular liquids and gases. We will learn about the statistico-mechanical approach to the liquid state, including distribution function theories, Boltzmann equation and Navier-Stokes equation. We will then move on to the dynamics of macromolecular liquids such as polymers. Based on concepts like viscosity and visco-elasticity, we will also explore thin film flows and non-Newtonian phenomena. The final part of the course will consider liquids composed of "macroscopic molecules" like sand grains. While their flow behavior is often reminiscent of molecular liquids, the dissipative nature of their interaction makes them an intrinsic out of equilibrium phenomenon.		
<b>Examination: Presentation (ca. 40 min.) and handout on special topic of choice</b> <b>Examination prerequisites:</b> Participation in course discussion and assignments <b>Examination requirements:</b> Students will perform an in-depth investigation on a particular course topic, and present this in a symposium at the end of the course.		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> StudiendekanIn der Fakultät für Physik; Ansprechpartner Dr. Marco Mazza	
<b>Course frequency:</b> unregelmäßig	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b>	<b>Recommended semester:</b>	

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three times	Master: 1 - 4
<b>Maximum number of students:</b> 50	
<b>Additional notes and regulations:</b> SP: Biophysik/nichtlineare Dynamik; Festkörperphysik; Materialphysik; Astrophysik; Geophysik	

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module M.Phys.5609: Turbulence Meets Active Matter</b>		4 WLH
<p><b>Learning outcome, core skills:</b>  <b>Lernziele:</b> This course introduces elements from turbulence theory and active matter theory. In particular, we will focus on emergent behavior of active agents as well as their collective behavior in disordered environments such as turbulent flows. The essential background will be conveyed in introductory lectures. The major part of the course is dedicated to hands-on projects, in which we will address the following questions: What are the challenges in describing and predicting turbulent flows? How can simple mathematical rules give rise to large-scale order and emergent behavior? How can complex patterns emerge in non-equilibrium systems and how can we describe them mathematically? How does spatio-temporal disorder impact emergent behavior? As part of the projects, the students will set up and conduct numerical experiments in small groups. The progress of the individual projects will be discussed in weekly meetings. Finally, the students will present their findings at the end of the semester.</p> <p><b>Kompetenzen:</b> The students gain an understanding of fundamental aspects of fluid mechanics and turbulence, agent-based models for collective behavior as well as elements of pattern formation. Furthermore, they acquire a basic understanding of numerical integration of ordinary and partial differential equations, post-processing and statistical analysis of simulation data, and scientific visualization of simulation results.</p>		<p><b>Workload:</b>  Attendance time: 56 h  Self-study time: 64 h</p>
<p><b>Courses:</b>  <b>1. Turbulence Meets Active Matter</b> (Lecture)  <b>2. Turbulence Meets Active Matter</b> (Exercise)</p>		<p>2 WLH  2 WLH</p>
<p><b>Examination: Oral examination (approx. 45 minutes)</b>  <b>Examination prerequisites:</b>  none  <b>Examination requirements:</b>  Understanding of the fundamentals taught in the fields of fluid physics and active matter, implementation of the acquired knowledge in accompanied research and programming projects, preparation of the presentation of the results and their classification in existing literature.</p>		4 C
<p><b>Admission requirements:</b>  Basic knowledge in mechanics and continuum mechanics, background in complex systems and stochastic processes</p>	<p><b>Recommended previous knowledge:</b>  none</p>	
<p><b>Language:</b>  English, German</p>	<p><b>Person responsible for module:</b>  Prof. Dr. Eberhard Bodenschatz</p>	
<p><b>Course frequency:</b>  every 4th semester; Wintersemester</p>	<p><b>Duration:</b>  1 semester[s]</p>	
<p><b>Number of repeat examinations permitted:</b>  three times</p>	<p><b>Recommended semester:</b>  1 - 4</p>	

<b>Maximum number of students:</b>	
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not limited	
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<b>Georg-August-Universität Göttingen</b>		6 C 6 WLH
<b>Module M.Phy.561: Advanced Topics in Biophysics/Physics of complex systems I</b>		
<b>Learning outcome, core skills:</b> <b>Learning outcome:</b> After successful completion of the modul students will be able to understand and apply advanced concepts of Biophysics/Physics of complex systems to current research topics. <b>Core skills:</b> Students will be able to describe and discuss state-of-the-art problems of Biophysics/Physics of complex systems.		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Course: Course (6 C) in the field of Biophysics and Physics of Complex Systems</b>		
<b>Examination: Written exam (120 min) or oral exam (ca. 30 min) or talk ( ca. 30 min), 2 weeks preparation time</b> <b>Examination requirements:</b> Advanced experimental techniques or theoretical models in Biophysics and Physics of Complex Systems.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 4	
<b>Maximum number of students:</b> 40		

<p><b>Georg-August-Universität Göttingen</b></p> <p><b>Modul M.Phys.5613: Vorlesung: Principles and Applications of Synchrotron and Free Electron Laser Radiation</b></p> <p><i>English title: Lecture: Principles and Applications of Synchrotron and Free Electron Laser Radiation</i></p>	<p>3 C 4 SWS</p>
<p><b>Lernziele/Kompetenzen:</b></p> <p>Lernziele: Ziel der Lehrveranstaltung ist die enge Verknüpfung der Lehre auf dem Gebiet der Röntgenphysik mit der Arbeit an Großforschungseinrichtungen, insbesondere der Forschung im Bereich Photon Science bei DESY. In der Vorlesung erhalten die Studierenden eine Einführung in die Forschung mit Synchrotronstrahlung und Strahlung von Freien Elektronen Lasern: Erzeugung der Strahlung und Charakteristika der Quellen, Grundlagen der Beschleunigerphysik, Experimentieraufbauten (Strahlrohre), Grundlagen der Röntgenbeugung und der Röntgenspektroskopie, Röntgenkurzzeitphysik. Im Blockkursus erlernen sie die Anwendung röntgenphysikalischer Methoden (mit jährlich wechselnden Schwerpunkten): kohärente Abbildung, mathematische Beschreibung, Anwendungen in der Biophysik, Molekülphysik, Kristallographie, Kurzzeitphysik, etc. (jeweils als Einführung).</p> <p>Kompetenzen: Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden...</p> <ul style="list-style-type: none"> <li>• über fundamentales Wissen über die Prinzipien der Erzeugung von Synchrotronstrahlung und der Strahlung von Freien Elektronenlasern deren Anwendungen verfügen;</li> <li>• Fähigkeiten in der mathematischen Beschreibung von Röntgenbeugung an ausgewählten, aktuellen Beispielen aus der Biophysik, Molekülphysik, Kristallographie etc. entwickelt haben.</li> </ul>	<p><b>Arbeitsaufwand:</b></p> <p>Präsenzzeit: 88 Stunden Selbststudium: 2 Stunden</p>
<p><b>Lehrveranstaltungen:</b></p> <p><b>1. Vorlesung (Vorlesung)</b></p> <p><i>Inhalte:</i> Einführung in die Forschung mit Synchrotronstrahlung und Strahlung von Freien Elektronen Lasern: Erzeugung der Strahlung und Charakteristika der Quellen, Grundlagen der Beschleunigerphysik, Experimentieraufbauten (Strahlrohre), Grundlagen der Röntgenbeugung und der Röntgen-spektroskopie, Röntgenkurzzeitphysik.</p> <p><b>2. Blockkurs Desy Campus, Hamburg (2,5 Tage)</b></p> <p><i>Inhalte:</i> Einführung in die Anwendungen röntgenphysikalischer Methoden (mit jährlich wechselnden Schwerpunkten) unter Anwendung hochenergetischer Strahlung: Einführung in die kohärente Abbildung, mathematische Beschreibung der Röntgenbildgebung, Anwendungen in der Biophysik, Molekülphysik, Kristallographie, Kurzzeitphysik, etc.</p>	<p>SWS</p>
<p><b>Prüfung: Mündlich (ca. 45 Minuten)</b></p>	<p>3 C</p>

<p><b>Prüfungsvorleistungen:</b> Aktive Teilnahme</p> <p><b>Prüfungsanforderungen:</b> Verständnis über die physikalischen Grundlagen der Forschung mit Synchrotronstrahlung und mit Strahlung von Freien Elektronen Lasern: Erzeugung der Strahlung und Charakteristika der Quellen, Grundlagen der Beschleunigerphysik, Experimentieraufbauten (Strahlrohre), Grundlagen der Röntgenbeugung, der Röntgenbildgebung und der Röntgenspektroskopie; Grundlagen der Röntgenkurzzeitphysik, Anwendung röntgenphysikalischer Methoden (mit jährlich wechselnden Schwerpunkten): kohärente Abbildung, mathematische Beschreibung, Anwendungen in der Biophysik, Molekülphysik, Kristallographie, Kurzzeitphysik, etc. (jeweils Einführung).</p>	
<p><b>Zugangsvoraussetzungen:</b> keine</p>	<p><b>Empfohlene Vorkenntnisse:</b> Einführung in die Röntgenphysik</p>
<p><b>Sprache:</b> Englisch</p>	<p><b>Modulverantwortliche[r]:</b> Prof. Dr. Simone Teichert</p>
<p><b>Angebotshäufigkeit:</b> jedes Wintersemester</p>	<p><b>Dauer:</b> 1 Semester</p>
<p><b>Wiederholbarkeit:</b> dreimalig</p>	<p><b>Empfohlenes Fachsemester:</b> Master: 1 - 4</p>
<p><b>Maximale Studierendenzahl:</b> 30</p>	
<p><b>Bemerkungen:</b> Einbringbar in folgende Schwerpunkte: Biophysik/komplexe Systeme, Festkörper/Materialphysik</p>	

<p><b>Georg-August-Universität Göttingen</b></p> <p><b>Modul M.Phys.5614: Praktikum: Principles and Applications of Synchrotron and Free Electron Laser Radiation</b></p> <p><i>English title: Lab Course: Principles and Applications of Synchrotron and Free Electron Laser Radiation</i></p>	<p>3 C 2 SWS</p>
<p><b>Lernziele/Kompetenzen:</b></p> <p>Lernziele: Ziel des Praktikums ist die enge Verknüpfung der praktisch orientierten Röntgenphysik-Hochschulausbildung mit der wissenschaftsorientierten, experimentellen Arbeit an Großforschungseinrichtungen, insbesondere der Forschung im Bereich Photon Science bei DESY.</p> <p>Im Blockpraktikum sollen die Studierenden ein praktisches Verständnis für komplexe Röntgenexperimente an Hochenergiestrahlungsquellen entwickeln, insbesondere an den (exemplarisch aufgelisteten) Strahlrohren P04, P08, P11, P24 des Speicherrings Petra III und der Strahlrohre PES und CAMP des Freien Elektronenlasers FLASH und FLASH II.</p> <p>Kompetenzen: Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden...</p> <ul style="list-style-type: none"> <li>• experimentelle Fähigkeiten und Basiswissen in Röntgenexperimenten entwickelt haben an ausgewählten, wissenschaftlich aktuellen Beispielen aus der Biophysik, Molekülphysik, Kristallographie etc.,</li> <li>• grundlegende experimentelle Expertise in Röntgenexperimenten an Hochenergiestrahlungsquellen erworben haben, u.a. auf dem Gebieten der Biophysik, Molekülphysik, Kristallographie, Kurzzeitphysik, etc.</li> </ul>	<p><b>Arbeitsaufwand:</b></p> <p>Präsenzzeit: 88 Stunden</p> <p>Selbststudium: 2 Stunden</p>
<p><b>Lehrveranstaltung: Einwöchiges Blockpraktikum am Desy</b></p> <p><i>Inhalte:</i></p> <p>Inhalte: Erlangung von experimentellen Fähigkeiten und Expertise von komplexen Röntgenexperimenten mit Hochenergiestrahlungsquellen; tieferes Verständnis von Röntgensynchrotron-Strahlungs-Experimente exemplarisch an Experimenten der Strahlrohre P04, P08, P11 oder P24 des Speicherrings Petra III und der Strahlrohre PES und CAMP des Freien Elektronenlasers FLASH oder FLASH II (wechselnde Schwerpunkte); Einführung in die Praxis röntgenphysikalischer: kohärente Abbildung, mathematische Beschreibung, Anwendungen in der Biophysik, Molekülphysik, Kristallographie, Kurzzeitphysik, etc.</p>	<p>2 SWS</p>
<p><b>Prüfung: Mündlich (ca. 45 Minuten)</b></p> <p><b>Prüfungsvorleistungen:</b> Aktive Teilnahme</p> <p><b>Prüfungsanforderungen:</b> Vorliegendes Protokoll zum Blockpraktikum mit eigenständig erarbeitetem Auswertinhalt (Einführungsniveau).</p>	<p>3 C</p>

<p>Grundlegende Kenntnisse zu Experimenten mit Synchrotronstrahlung und Strahlung von Freien Elektronen Lasern. Exemplarisch: Grundlegendes Verständnis an aktueller Beispiele von Röntgenexperimenten aus den Gebieten der Biophysik, Molekülphysik, Biophysik, Molekülphysik, Kristallographie, Kurzzeitphysik, etc. (je nach Praktikumsort an P04, P08, P11 oder P24 des Speicherrings Petra III und der Strahlrohre PES und CAMP des Freien Elektronenlasers FLASH oder FLASH II).</p> <p>Nachweis experimenteller Fähigkeiten, Nachweis von mathematische Expertise (weitreichendere Grundlagen) zur Auswertung von Röntgenexperimenten, Reflektion der durchgeführten Experimente.</p>	
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<p><b>Zugangsvoraussetzungen:</b> keine</p>	<p><b>Empfohlene Vorkenntnisse:</b> Einführung in die Röntgenphysik</p>
<p><b>Sprache:</b> Englisch</p>	<p><b>Modulverantwortliche[r]:</b> Prof. Dr. Simone Techert</p>
<p><b>Angebotshäufigkeit:</b> jedes Wintersemester</p>	<p><b>Dauer:</b> 1 Semester</p>
<p><b>Wiederholbarkeit:</b> dreimalig</p>	<p><b>Empfohlenes Fachsemester:</b> Master: 1 - 4</p>
<p><b>Maximale Studierendenzahl:</b> 10</p>	

<p><b>Bemerkungen:</b> Einbringbar in folgende Schwerpunkte: Biophysik/komplexe Systeme, Festkörper/Materialphysik</p>
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<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Phy.562: Advanced Topics in Biophysics/Physics of complex systems II</b>		
<b>Learning outcome, core skills:</b> After successful completion of the modul students should be familiar with advanced concepts of Biophysics and Physics of Complex Systems.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Course (3 C) in the Field of Biophysics/Physics of complex systems</b>		2 WLH
<b>Examination: Written exam (120 min) or oral exam (ca. 30 min) or talk ( ca. 30 min), 2 weeks preparation time</b> <b>Examination requirements:</b> Advanced experimental techniques or theoretical models in Biophysics and Physics of Complex Systems		3 C
<b>Course: Course (3 C) in the Field of Biophysics/Physics of complex systems</b>		2 WLH
<b>Examination: Written exam (120 min) or oral exam (ca. 30 min) or talk ( ca. 30 min), 2 weeks preparation time</b> <b>Examination requirements:</b> Advanced experimental techniques or theoretical models in Biophysics and Physics of Complex Systems		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 4	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		4 C 2 WLH
<b>Module M.Phy.566: Seminar Advanced Topics in Biophysics/Complex Systems</b>		
<b>Learning outcome, core skills:</b> After successful completion of the modul students should be familiar with the presentation of complex problems, scientific discussion as well as evaluation of contents of the presentations.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Seminar Advanced Topics in Biophysics/Complex Systems</b>		
<b>Examination: Lecture, 4 weeks preparation time (approx. 60 minutes)</b> <b>Examination prerequisites:</b> active Participation <b>Examination requirements:</b> Advanced experimental techniques or theoretical models in astro- or geophysics		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> 1 - 2	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module M.Phy.5701: Advanced Solid State Theory</b>		6 WLH
<b>Learning outcome, core skills:</b> After successful completion of the modul students should be able to perform calculations using many-body techniques, describe and model simple experimental observations, understand and use the language of modern solid-state theory.		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Courses:</b> <b>1. Lecture</b>		4 WLH
<b>2. Exercises</b>		2 WLH
<b>Examination: written exam (90 min.) or oral exam (approx. 30 min.)</b> <b>Examination requirements:</b> Quantum-field theoretical description of solids, elements of ab initio methods, symmetries and binding, optical properties of solids, correlated electron systems, elements of transport theory.  Formulation of theories based on experimental observation, description and interpretation of experiments in solids, knowledge of manybody techniques		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Solid State Physics Quantum mechanics I	
<b>Language:</b> English	<b>Person responsible for module:</b> Dean of Studies, Faculty of Physics	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Master: 2 - 3	
<b>Maximum number of students:</b> 40		



<b>Georg-August-Universität Göttingen</b> <b>Modul M.Phys.5703: Materialforschung mit Elektronen</b> <i>English title: Materials research with electrons</i>		6 C 4 SWS
<b>Lernziele/Kompetenzen:</b> Nach erfolgreichem Absolvieren des Moduls sollten die Studierenden die grundlegenden elektronenoptischen und spektroskopischen Methoden kennen und in der Auswertung von Untersuchungsergebnissen anwenden können.	<b>Arbeitsaufwand:</b> Präsenzzeit: 56 Stunden Selbststudium: 124 Stunden	
<b>Lehrveranstaltung: Vorlesung mit Seminar</b>		
<b>Prüfung: Vortrag (ca. 60 Min.) oder mündliche Prüfung (ca. 30 Min.)</b> <b>Prüfungsvorleistungen:</b> Aktive Teilnahme im Seminar		
<b>Prüfungsanforderungen:</b> Kenntnisse grundlegender elektronenoptischer und –spektroskopischer Methoden und ihrer praktischen Anwendung auf materialphysikalische Fragestellungen  Grundlagen der Transmissionselektronenmikroskopie, Wechselwirkung von Elektronen mit Materialien, Elektronenbeugung, Hochofflösung, Rastertransmissionselektronenmikroskopie Analytische Methoden wie EDX und EELS, In-situ Verfahren, Dynamische und ultraschnelle Elektronenmikroskopie.		
<b>Zugangsvoraussetzungen:</b> keine	<b>Empfohlene Vorkenntnisse:</b> Quantenmechanik I  Einführung in die Materialphysik  Einführung in die Festkörperphysik	
<b>Sprache:</b> Deutsch	<b>Modulverantwortliche[r]:</b> StudiendekanIn der Fakultät für Physik	
<b>Angebotshäufigkeit:</b> 2jährig (SoSe)	<b>Dauer:</b> 1 Semester	
<b>Wiederholbarkeit:</b> dreimalig	<b>Empfohlenes Fachsemester:</b> Master: 1 - 3	
<b>Maximale Studierendenzahl:</b> 25		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module M.Phy.5705: Materials Physics I: Microstructure-Property-Relations</b>		3 WLH
<b>Learning outcome, core skills:</b> After successful completion of this Module, the student will have obtained an overview about the realistic structure of materials (realistic = including defects and irregularities). In addition, a deepened understanding of the relation between microstructure and fundamental material properties will have been gained via the discussion of theoretical models and experimental results.		<b>Workload:</b> Attendance time: 42 h Self-study time: 78 h
<b>Course: Materials Physics I: Microstructure-Property-Relations</b> <i>Contents:</i> Basic concepts of structure-property relations and defects, topology, thermodynamics and properties of defects, microstructure and mechanical properties.		
<b>Examination: Presentation (approximately 30 minutes) or written examination (120 minutes) or oral examination (approximately 30 minutes)</b> <b>Examination prerequisites:</b> At least 50% of the homework problems need to be solved correctly. <b>Examination requirements:</b> Global and local symmetries in materials, elastic continuum theory, structure of point defects, dislocations and grain boundaries, thermodynamics of defects, mechanical / chemical / electronic / transport properties of defects, as well as methods for the investigation of micro-structure and related properties.		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introductory courses in materials science and solid state physics.	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof.in Cynthia Volkert	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 3	
<b>Maximum number of students:</b> not limited		

<b>Georg-August-Universität Göttingen</b>		4 C 3 WLH
<b>Module M.Phy.5706: Materials Physics II: Kinetics and Phase Transformations</b>		
<b>Learning outcome, core skills:</b> After successful completion of this Module, the student will have obtained an overview of theoretical concepts and mechanisms of phase transformations in materials. In addition, a deeper understanding of the description of kinetic processes in the framework of irreversible thermodynamics will have been gained.	<b>Workload:</b> Attendance time: 42 h Self-study time: 78 h	
<b>Course: Materials Physics II: Kinetics and Phase Transformations</b> <i>Contents:</i> Fundamentals and specific examples of the behavior of condensed mattersystems in non-equilibrium situations.		
<b>Examination: Presentation (approximately 30 minutes) or written exam (120 minutes) or oral examination (approximately 30 minutes)</b> <b>Examination prerequisites:</b> At least 50% of the homework problems need to be solved correctly. <b>Examination requirements:</b> Non-equilibrium thermodynamics, generalized driving forces, diffusion, nucleation, motion and instabilities of interfaces, solidification, precipitation, domain growth, spinodal decomposition, order-disorder phase transitions, kinetically controlled transformations.		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introductory courses in materials science and solid state physics, as well as the course Materials Physics I.	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof.in Cynthia Volkert	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 2 - 4	
<b>Maximum number of students:</b> not limited		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module M.Phy.5707: Materials research with electrons</b>		2 WLH
<b>Learning outcome, core skills:</b> Fundamentals of the application of electron microscopy to the characterization and analysis of materials, with emphasis on: <ul style="list-style-type: none"> <li>• Interactions between electrons and solids</li> <li>• Preparation of samples, limits of electron microscopy</li> <li>• Fundamentals and advanced concepts of electron microscopy</li> <li>• Diffraction and imaging</li> <li>• Analytical applications (EDX, EELS, GPA, ...)</li> <li>• Overview of current research topics</li> </ul> <p>After successful completion of this Module, the student will be able to understand further developments of electron microscopy and gain access to current research themes.</p>		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Materials research with electrons (Lecture)</b>		
<b>Examination: Oral examination, (approximately 30 minutes)</b> <b>Examination requirements:</b> Understanding of fundamental concepts, facts, and methods. Basic understanding of diffraction, imaging, and analysis.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introductory courses in materials science and solid state physics.	
<b>Language:</b> English	<b>Person responsible for module:</b> apl. Prof. Dr. Michael Seibt	
<b>Course frequency:</b> Every 2 years, summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Master: 1 - 4	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module M.Phy.5708: Physics of Semiconductor Devices</b>		2 WLH
<b>Learning outcome, core skills:</b> After successful completion of this module the students will be able to understand basic and advanced concepts of the physics of electronic and opto-electronic semiconductor devices.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Physics of Semiconductor Devices (Lecture with seminar)</b>		2 WLH
<b>Examination: Oral examination (approx. 45 minutes)</b> <b>Examination prerequisites:</b> active participation in seminar <b>Examination requirements:</b> Basic and advanced concepts of the physics of semiconductors and their devices.		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Einführung in die Festkörperphysik, Solid State Physics II	
<b>Language:</b> English	<b>Person responsible for module:</b> apl. Prof. Dr. Michael Seibt	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 3	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module M.Phy.5709: Physics of Semiconductors</b>		2 WLH
<b>Learning outcome, core skills:</b> After successful completion of this module the students will be able to understand basic and advanced concepts of the physics of semiconductors and their devices with emphasis on: <ul style="list-style-type: none"> <li>• <b>electronic transport</b></li> <li>• <b>doping</b></li> <li>• <b>electronic states</b></li> <li>• <b>optical properties</b></li> <li>• <b>semiconductor junctions</b></li> <li>• <b>nanostructures</b></li> </ul>		<b>Workload:</b> Attendance time: 28 h Self-study time: 62 h
<b>Course: Physics of Semiconductors (Lecture)</b>		
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> Basic and advanced concepts of the physics of semiconductors.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Einführung in die Festkörperphysik, Solid State Physics II	
<b>Language:</b> English	<b>Person responsible for module:</b> apl. Prof. Dr. Michael Seibt	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 4	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b>		6 C 6 WLH
<b>Module M.Phy.571: Advanced Topics in Solid State/Materials Physics I</b>		
<b>Learning outcome, core skills:</b> <b>Learning outcome:</b> After successful completion of the modul students will be able to understand and apply advanced concepts of Solid State/Materials Physics to current research topics. <b>Core skills:</b> Students will be able to describe and discuss state-of-the-art problems of Solid State/Materials Physics.		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Course: A course (6 C) in the field of Solid State/Materials Physics</b>		
<b>Examination: Written exam (120 min) or oral exam (ca. 30 min) or talk ( ca. 30 min), 2 weeks preparation time</b> <b>Examination requirements:</b> Advanced experimental techniques or theoretical models in Solid State/Materials Physics		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Master: 1 - 4	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Phy.5710: Physics of Semiconductors and Semiconductor Devices</b>		
<b>Learning outcome, core skills:</b> After successful completion of this module the students will be able to understand basic and advanced concepts of the physics of semiconductors and their devices with emphasis on: <ul style="list-style-type: none"> <li>• electronic transport</li> <li>• doping</li> <li>• electronic states</li> <li>• optical properties</li> <li>• semiconductor junctions</li> <li>• nanostructures</li> <li>• physics of electronic and opto-electronic devices</li> </ul>		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Physics of Semiconductors and Semiconductor Devices (Lecture with seminar)</b> (Lecture, Seminar)		4 WLH
<b>Examination: Presentation (approx. 60 min.) or oral examination (approx. 30 min.)</b> <b>Examination prerequisites:</b> regular attendance in seminar <b>Examination requirements:</b> Basic and advanced concepts of the physics of semiconductors and their devices.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Einführung in die Festkörperphysik, Solid State Physics II	
<b>Language:</b> English	<b>Person responsible for module:</b> apl. Prof. Dr. Michael Seibt	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 4	
<b>Maximum number of students:</b> 20		



<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module M.Phy.5711: Surface Physics</b>		2 WLH
<p><b>Learning outcome, core skills:</b>  <b>Learning outcome:</b> After having successfully completed the module students should understand the fundamental concepts of the rapidly evolving field of surface physics. They should be able to transfer this knowledge to other areas like the physics of nanostructures and interfaces.</p> <p>More specifically, the students will have basic knowledge in the following topics:</p> <ol style="list-style-type: none"> <li>1. Geometry of surfaces (e.g. relaxation, reconstruction, Wood's notation)</li> <li>2. Electronic states of surfaces (e.g. surface states, projected band structure)</li> <li>3. Processes at surfaces (e.g. adsorption, growth, diffusion)</li> <li>4. Preparation and analysis of surfaces (e.g. UHV techniques, STM, LEED, PES)</li> <li>5. Surface Excitations (e.g. surface phonons, surface plasmons)</li> <li>6. Interfaces, Nanostructures</li> </ol> <p><b>Core skills:</b> The students will have a fundamental understanding of the general structural and electronic properties of solid state surfaces. They will have a basic knowledge of current surface preparation and surface analysis methods.</p>		<p><b>Workload:</b>  Attendance time: 28 h  Self-study time: 62 h</p>
<b>Course: Surface Physics</b> (Lecture)		
<p><b>Examination: Oral examination (approx. 30 minutes)</b>  <b>Examination requirements:</b>  Basic knowledge and understanding of surface physics, i.e. atomic and electronic structure of solid surfaces including concepts like e.g. reconstruction, surface states, surface phonons, adsorption, experimental methods.</p>		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> B.Phy.1521: Introduction to Solid State Physics	
<b>Language:</b> English, German	<b>Person responsible for module:</b> PD Dr. Martin Wenderoth	
<b>Course frequency:</b> every 4th semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 4	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Phy.5712: Topology in Condensed Matter Physics</b>		
<b>Learning outcome, core skills:</b> After a successful completion of the course, the students will be familiar with the basic concepts and properties of topological states of matter in condensed matter physics and representative examples.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Courses:</b>		
1. <b>Topology in Condensed Matter Physics</b> (Lecture)		2 WLH
2. <b>Topology in Condensed Matter Physics</b> (Exercise)		2 WLH
<b>Examination: Written exam (120 min.) or oral exam (ca. 30 min.)</b>		
<b>Examination requirements:</b> Basic concepts of topological states of matter in condensed matter physics and knowledge and understanding of representative examples.		
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> <ul style="list-style-type: none"> <li>• Solid State Physics,</li> <li>• Introduction to Solid State Theory,</li> <li>• <u>Quantum mechanics I</u></li> </ul>	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Fabian Heidrich-Meisner	
<b>Course frequency:</b> every 4th semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 4	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Phys.572: Advanced Topics in Solid State/Materials Physics II</b>		
<b>Learning outcome, core skills:</b> After successful completion of the modul students should be familiar with advanced concepts of Solid State/Materials Physics.		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: Course (3 C) in the field of Solid State/Materials Physics</b>		2 WLH
<b>Examination: Written exam (120 min) or oral exam (ca. 30 min) or talk ( ca. 30 min), 2 weeks preparation time</b> <b>Examination requirements:</b> Advanced experimental techniques or theoretical models in Solid State/Materials Physics		3 C
<b>Course: Course (3 C) in the field of Solid State/Materials Physics</b>		2 WLH
<b>Examination: Written exam (120 min) or oral exam (ca. 30 min) or talk ( ca. 30 min), 2 weeks preparation time</b> <b>Examination requirements:</b> Advanced experimental techniques or theoretical models in Solid State/Materials Physics		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies	
<b>Course frequency:</b> each semester	<b>Duration:</b> 2 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 4	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		4 C 2 WLH
<b>Module M.Phy.576: Seminar Advanced Topics in Solid State/Materials Physics</b>		
<b>Learning outcome, core skills:</b> After successful completion of the modul students should be familiar with the presentation of complex problems, scientific discussion as well as evaluation of contents of the presentations.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Seminar Advanced Topics in Solid State/Materials Physics</b>		
<b>Examination: Lecture, 4 weeks preparation time (approx. 60 minutes)</b> <b>Examination prerequisites:</b> active participation <b>Examination requirements:</b> Advanced experimental techniques or theoretical models in Solid State/Materials Physics		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> 1 - 2	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		3 C
<b>Module M.Phy.5801: Detectors for particle physics and imaging</b>		3 WLH
<b>Learning outcome, core skills:</b> After successful completion of this module, students should be familiar with modern methods and questions about detector physics in high energy physics, imaging and related fields.		<b>Workload:</b> Attendance time: 42 h Self-study time: 48 h
<b>Course: Detectors for particle physics and imaging</b>		
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> Based on the introductory lecture "interactions between radiation and matter" this lecture covers special topics of detector physics such as the layout of certain detector types (i.e. semiconductor detectors, ionisation detectors etc.), readout systems and noise contribution, radiation damage of detector material and readout as well as the application of such detectors.		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Arnulf Quadt	
<b>Course frequency:</b> every 4th semester; irregular	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Master: 1 - 3	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b>		3 C 3 WLH
<b>Module M.Phy.5804: Simulation methods for theoretical particle physics</b>		
<b>Learning outcome, core skills:</b> The aim of the lecture is to convey the theoretical foundations of simulations of particle-physics scattering experiments. While the relevant theoretical concepts get introduced and discussed in the lectures, the tutorials provide hands-on experience with corresponding computer codes. The successful participation in the module the students will have experience with the tools and methods used in high-energy particle physics research. They will be in a position to carry out corresponding calculations and understand contemporary research subjects		<b>Workload:</b> Attendance time: 42 h Self-study time: 48 h
<b>Courses:</b> <b>1. Tutorial Simulation methods for theoretical particle physics</b> <b>2. Lecture Simulation methods for theoretical particle physics (Lecture)</b>		1 WLH 2 WLH
<b>Examination: Written exam (30 Min.) or oral exam (approx. 30 Min.)</b> <b>Examination requirements:</b> Solid understanding of the foundations of the theoretical description of high-energy scattering experiments. Ability to carry out corresponding calculations and simulations.		3 C
<b>Admission requirements:</b> keine	<b>Recommended previous knowledge:</b> Quantum mechanics II, Quantum Field Theory	
<b>Language:</b> English	<b>Person responsible for module:</b> Prof. Dr. Steffen Schumann	
<b>Course frequency:</b> every 4th semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Master: 1 - 4	
<b>Maximum number of students:</b> 30		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module M.Phys.5807: Particle Physics III - of and with leptons</b>		6 WLH
<b>Learning outcome, core skills:</b> After successful completion of this module, students should be familiar with the properties and interactions of leptons as well as with experimental methods and experiments which lead to their discovery and are used for precise studies.		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Course: Lecture and exercises - Particle Physics III</b>		
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> Discovery of leptons, properties of leptons, weak interactions and V-A structure, neutral currents, standard model of particle physics, e+e- physics at LEP, fermion pair production at varying center of mass energy, lineshape of cross-section at Z-pole, number of light neutrino generations, forward-backward-asymmetry, tau-polarisation, e+e- physics at the LHC, (g-2)_myon, neutrinos and neutrino oscillations, solar neutrinos, atmospheric neutrinos, long-baseline experiments, neutrino factories, neutrino mass, neutrinoless double-beta decay.		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to Nuclear/Particle Physics	
<b>Language:</b> German, English	<b>Person responsible for module:</b> Prof. Dr. Arnulf Quadt	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> Master: 1 - 3	
<b>Maximum number of students:</b> not limited		

<b>Georg-August-Universität Göttingen</b> <b>Module M.Phy.581: Advanced Topics in Nuclear and Particle Physics I</b>	6 C 6 WLH
<b>Learning outcome, core skills:</b> <b>Learning outcome:</b> After successful completion of the modul students will be able to understand and apply advanced concepts of Nuclear and Particle Physics to current research topics. <b>Core skills:</b> Students will be able to describe and discuss state-of-the-art problems of Nuclear and Particle Physics.	<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Course: A Course (6 C) in the field of Nuclear and Particle Physics</b>	
<b>Examination: Written examination (120 Min.) or oral examination approx. 30 Min.) or talk (approx. 30 Min.),2 weeks preparation time</b> <b>Examination requirements:</b> Advanced experimental techniques or theoretical models in Nuclear and Particle Physics	
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 4
<b>Maximum number of students:</b> 40	



<b>Georg-August-Universität Göttingen</b> <b>Module M.Phy.5810: Physics and Applications of Ion solid interaction</b>		6 C 6 WLH
<b>Learning outcome, core skills:</b> After successful completion of the module students should be familiar with theoretical background and advanced concepts of ion solid interaction, electronic and nuclear energy loss, thermal spikes, ion sputtering, ion beam analysis techniques, ion implantation, ion accelerators and ion sources, simulation of ion solid interaction, ion induced surface pattern formation, ion microscopy and focused ion beam techniques.		<b>Workload:</b> Attendance time: 84 h Self-study time: 96 h
<b>Courses:</b> <b>1. Physics and Applications of Ion solid interaction in the field of Solid State/ Materials Physics (Lecture)</b> <b>2. Practical lab exercises Physics and Applications of Ion solid interaction in the field of Solid State/Materials Physics</b>		4 WLH 2 WLH
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> Advanced experimental techniques and theoretical models in ion-solid interaction		6 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to solid state physics	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Hans Christian Hofsäss	
<b>Course frequency:</b> each summer semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 4	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module M.Phy.5811: Nuclear Solid State Physics</b>		2 WLH
<b>Learning outcome, core skills:</b> After successful completion of the module students should be familiar with the physics of hyperfine interactions and interaction of nuclear moments with external magnetic and electric fields, Mössbauer spectroscopy and perturbed angular correlation of gamma radiation, nuclear magnetic resonance techniques, myon spin rotation, positron annihilation spectroscopy, neutron scattering and electron emission channeling.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Courses:</b> <b>1. Nuclear solid state physics in the field of Nuclear and Particle Physics and/or Solid State and Materials Physics (Lecture)</b>		4 WLH
<b>2. Exercises in the field of Nuclear and Particle Physics and/or Solid State and Materials Physics (Exercise)</b>		2 WLH
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> Nuclear solid state physics concepts and techniques, physics of hyper fine interactions, interaction of neutrons with matter, physics of nuclear resonance techniques, application of positrons, myons and decay electrons to materials characterization.		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to nuclear and particle physics Introduction to solid state physics	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Hans Christian Hofsäss	
<b>Course frequency:</b> each winter semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 4	
<b>Maximum number of students:</b> 20		

<b>Georg-August-Universität Göttingen</b>		4 C
<b>Module M.Phy.5812: Nuclear Reactor Physics</b>		4 WLH
<b>Learning outcome, core skills:</b> After successful completion of the module students should be familiar with the physics concepts of nuclear reactors, nuclear fission and breeding, neutron kinetics, neutron diffusion and neutron balance, criticality and reactivity, delayed neutrons, temperature effects on reactivity, chemical shim and burnable poisons, fast breeders, high temperature reactors, research reactors, enrichment, nuclear fuel cycle and radioactive waste, risk management		<b>Workload:</b> Attendance time: 56 h Self-study time: 64 h
<b>Courses:</b> <b>1. Nuclear reactor physics in the field of Nuclear and Particle Physics (Lecture)</b> <b>2. Tutorial Nuclear reactor physics in the field of Nuclear and Particle Physics (Tutorial)</b>		2 WLH 2 WLH
<b>Examination: Oral examination (approx. 30 minutes)</b> <b>Examination requirements:</b> Physics of nuclear reactors and nuclear reactor concepts		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> Introduction to nuclear and particle physics	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Prof. Dr. Hans Christian Hofsäss	
<b>Course frequency:</b> 1	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 4	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		6 C 4 WLH
<b>Module M.Phy.582: Advanced Topics in Nuclear and Particle Physics II</b>		
<b>Learning outcome, core skills:</b> After successful completion of the modul students should be familiar with advanced concepts of Nuclear and Particle Physics		<b>Workload:</b> Attendance time: 56 h Self-study time: 124 h
<b>Course: A Course (3 C) in the field of Nuclear and Particle Physics</b>		2 WLH
<b>Examination: Written exam (120 min) or oral exam (ca. 30 min) or talk ( ca. 30 min), 2 weeks preparation time</b> <b>Examination requirements:</b> Advanced experimental techniques or theoretical models in Nuclear and Particle Physics		3 C
<b>Course: A Course (3 C) in the field of Nuclear and Particle Physics</b>		2 WLH
<b>Examination: Written exam (120 min) or oral exam (ca. 30 min) or talk ( ca. 30 min), 2 weeks preparation time</b> <b>Examination requirements:</b> Advanced experimental techniques or theoretical models in Nuclear and Particle Physics		3 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies	
<b>Course frequency:</b> each semester	<b>Duration:</b> 2 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 4	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		4 C 2 WLH
<b>Module M.Phys.586: Seminar Advanced Topics in Nuclear and Particle Physics</b>		
<b>Learning outcome, core skills:</b> After successful completion of this module, students should be able to reproduce and present complex chains of arguments, assess their own and other students' presentation critically.		<b>Workload:</b> Attendance time: 28 h Self-study time: 92 h
<b>Course: Seminar Advanced Topics in Nuclear and Particle Physics</b>		
<b>Examination: Lecture, 4 weeks preparation time (approx. 60 minutes)</b> <b>Examination prerequisites:</b> Active participation <b>Examination requirements:</b> Preparation of complex topics for presentation and scientific discussion.		4 C
<b>Admission requirements:</b> none	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies	
<b>Course frequency:</b> each semester	<b>Duration:</b> 1 semester[s]	
<b>Number of repeat examinations permitted:</b> twice	<b>Recommended semester:</b> 1 - 2	
<b>Maximum number of students:</b> 40		

<b>Georg-August-Universität Göttingen</b>		6 C
<b>Module M.Phy.603: Writing scientific articles</b>		2 WLH
<b>Learning outcome, core skills:</b> <b>Objective:</b> Basics of writing a scientific paper, form and content of a Scientific paper, correspondence with scientific journals, understanding and imparting of content of current research, scientific discussion with co - authors <b>Competences:</b> After successfully completing the module students should know how to... <ul style="list-style-type: none"> <li>• write a scientific article</li> <li>• submit a publication in the respective field</li> <li>• impart their independently developed effort</li> </ul>		<b>Workload:</b> Attendance time: 28 h Self-study time: 152 h
<b>Courses:</b> <b>1. Workshop</b> <b>2. Accompanying Seminar</b>		1 WLH 1 WLH
<b>Examination: written report (max. 20 S.), not graded</b> <b>Examination prerequisites:</b> active participation		6 C
<b>Examination requirements:</b> a) Writing scientific articles b) Submit scientific publications		
<b>Admission requirements:</b> The Bachelor Thesis has to... <ul style="list-style-type: none"> <li>• meet high academic standards</li> <li>• be a scientific progress in the science</li> <li>• be an independent performance</li> </ul> The determination of the access authorization is performed by the module responsible. She/He may request the opinion of an authorized examiner in the related field.	<b>Recommended previous knowledge:</b> none	
<b>Language:</b> English, German	<b>Person responsible for module:</b> Dean of Studies of the Faculty of Physics	
<b>Course frequency:</b> each semester; nach Bedarf	<b>Duration:</b> 2 semester[s]	
<b>Number of repeat examinations permitted:</b> three times	<b>Recommended semester:</b> 1 - 4	
<b>Maximum number of students:</b> not limited		