phy613 - Advanced Physics II

Module label
Advanced Physics II

Module code
phy613

Credit points
6.0 KP

Workload
180 h

Used in course of study
- Master's Programme Engineering Physics > Pflichtmodule

Contact person
Björn Poppe

Entry requirements
Skills to be acquired in this module
- Theoretical Physics III: Quantum mechanics (M.Ed.):
  The students obtain competencies to identify application situations of quantum mechanics and to solve standard problems as well as to be able to impart knowledge properly (i.a. at schools).

- General Relativity:
  The students acquire basic knowledge in the field of general relativity as well as of aspects of astrophysics and cosmology. They obtain skills for a confident application of modern methods of theoretical physics. These include in particular differential geometric concepts and quantitative analysis of advanced problems of theoretical physics. They enhance their competences to effectively deal with sophisticated problems of theoretical physics, to independently develop approaches to current issues of theoretical physics, and to comprehend common concepts and methods of theoretical physics and the natural sciences, in general.

- Acoustics:
  Thorough understanding of acoustics and ability to make quantitative descriptions of phenomena in physical acoustics such as mechanical oscillations, acoustical wave propagation, reflections at boundaries, room acoustical properties, diffraction, and electro acoustical systems. Understanding of important concepts such as acoustical impedance, Q-factor, resonances, near and far field, standing waves, room modes, etc..

Module contents
- Theoretical Physics III: Quantum mechanics (M.Ed.):
  Basic concepts and structures of non-relativistic quantum mechanics ( superposition principle, wave function, operators, eigenvalue problem, probabilistic interpretation, Schrödinger equation, Hilbert space and current topics like quantal measurement without interaction, Bell’s inequality, decoherence), interpretation problems and questions of impartation of quantum mechanics at schools or other places.

- General Relativity:
  - equivalence principle
  - motion in the gravitational field
  - metric
  - tensors
  - covariant differentiation
  - Riemann curvature tensor
  - Einstein’s field equations
  - conserved quantities
  - Schwarzschild solution
  - black holes
  - gravitational radiation
  - experimental tests
  - cosmology
  - Friedmann equations

- Acoustics:
  - Oscillations and waves
  - Physical fundamentals of acoustics
  - Generation and propagation of sound
  - Measurement and evaluation of sound
  - Processing and analysis of acoustic signals
  - Acoustics of voice and speech
  - Speech pathology
  - Acoustic insulation and attenuation
  - Room and building acoustics
  - Electro acoustics
  - Shock waves
  - Photoacoustic effect
  - Selected topics of acoustics, vibrations and ultrasonic
Reader's advisory
Theoretische Physik III: Quantenmechanik (M.Ed.)
C. Cohen-Tannoudji, et al.: Quantenmechanik, de Gruyter;
W. Nolting: Grundkurs Theoretische Physik, 5 Quantenmechanik, Springer Verlag;
J. Pade: Quantenmechanik zu Fuß, Springer (auch englisch: Quantum Mechanics for Pedestrians 1 & 2, Springer);
J. Audretsch: Verschränkte Welt, Wiley;
F. Selleri: Die Debatte um die Quantentheorie, Vieweg Verlag.

Allgemeine Relativitätstheorie
J. B. Hartle: Gravity: an introduction to Einstein’s general relativity. Addison-Wesley, San Francisco (CA), 2003

Akustik
Kollmeier, B.: Skriptum Physikalische, technische und medizinische Akustik, Universitaet Oldenburg
Heckl, Müller: Taschenbuch der technischen Akustik, Springer Verlag
F.G. Kollmann: Maschinenakustik, Springer Verlag

Links
Languages of instruction
German, English

Duration (semesters)
1 Semester

Module frequency
halbjährlich

Module capacity
unlimited

Modullevel
MM (Mastermodul)

Lern-/Lehrform / Type of program
Wahlpflicht

Vorkenntnisse / Previous knowledge

Examination
Time of examination
Type of examination
Final exam of module
1 writen exam oder 1 präsentation oder 1 oral exam oder 1 seminar paper

Course type
Seminar

SWS
Frequency
0 h

Workload attendance