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  
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, Universität 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**

**Vorkenntnisse / Previous knowledge**

**Examination**  
Time of examination  
Type of examination  
Final exam of module  
1 written exam oder 1 presentation oder 1 oral exam oder 1 seminar paper

**Course type**  
Seminar

**SWS**

**Frequency**

**Workload attendance**  
0 h