Module title: Solid State Physics 2  
Abbreviation: 11-FK2-Int-201-m01

Module coordinator: Managing Director of the Institute of Applied Physics  
Module offered by: Faculty of Physics and Astronomy  
ECTS: 8  
Method of grading: numerical grade  
Duration: 1 semester  
Module level: graduate  
Other prerequisites: Approval from examination committee required.

Contents:
1. Electrons in a periodic potential – the band structure
   a. Electrical and thermal transport
   b. Bloch theorem
   c. Electrons
2. Semi-classical models of dynamic processes
   a. Electrical transport in partially and completely filled bands
   b. Fermi surfaces; measurement techniques
   c. Electrical transport in external magnetic fields
   d. Boltzmann-equations of transport
3. The dielectric function and ferroelectrics
   a. Macroscopic electrodynamics and microscopic theory
   b. Polarizability of solids, of lattices, of valence electrons and quasi-free electrons; optical phonons, polaritons, plasmons, inter-band transitions, Wannier-Mott excitons
   c. Ferromagnetism
4. Semiconductors
   a. Characteristics
   b. Intrinsic semiconductors
   c. Doped semiconductors
   d. Physics and applications of p-n junctions
   e. Heterostructures
5. Magnetism
   a. Atomic dia- and paramagnetism
   b. Dia- and paramagnetism in metals
   c. Ferromagnetism
6. Superconductivity
   a. Phenomena
   b. Models of superconductivity
   c. Tunnel experiments and applications

Intended learning outcomes:
Knowledge of effects, concepts and models in advanced solid state physics. Familiarity with the theoretical principles and with applications of experimental methods.

Courses (type, number of weekly contact hours, language — if other than German):
V (4) + R (2)  
Module taught in: English

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus):
a) written examination (approx. 90 to 120 minutes) or b) oral examination of one candidate each (approx. 30 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes per candidate) or d) project report (approx. 8 to 10 pages) or e) presentation/talk (approx. 30 minutes).
If a written examination was chosen as method of assessment, this may be changed and assessment may instead take the form of an oral examination of one candidate each or an oral examination in groups. If the method
of assessment is changed, the lecturer must inform students about this by four weeks prior to the original examination date at the latest.
Assessment offered: In the semester in which the course is offered and in the subsequent semester
Language of assessment: English

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<td>Master's degree (1 major) Quantum Engineering (2020)</td>
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