Secondary Area of Specialization

Molecular Physics

Module No.: MN-P-PN-Mol **status quo 08.05.2012**

	HPW	estimated effort (h)	credit points
Lecture Course	4 + 3(2)	180	6
Problem Class	1	60	2
Total	7(6)	240	8

Contents

The module is subdivided into core courses, specialized courses and the advanced seminar:

1. Core Courses
    - Molecular Physics I (3+1 hpw): Basics of Molecular Spectroscopy, Interaction of Radiation with Matter, Chemical Bond, Born- Oppenheimer-Approximation, Rigid Rotor, Harmonic Oscillator, Electronic States, Group Theory
    - Molecular Physics II (3+1 hpw): Rotational Spectroscopy, Vibrational Spectroscopy, Group Theory, Coupling of Rotation and Vibration, Transitions and Selection Rules, Nuclear Spin Statistics, Coupling of Angluar Momentum, Hund`s Cases, FS,HFS
2. Specialized courses
    - Astrochemistry (2 SWS)
    - Experimental Methods of Molekular Physics (2 SWS)
    - Experimentel Methods of Astrophysics (2 SWS)
    - Symmetry / Group Theory (2 SWS)
    - Fouriertransformations and their Applications (2 SWS)
    - Starformation (2 SWS)
    - and others

The contents of the specialized courses can be found in the "kommentiertes Vorlesungsverzeichnis"

Literature

Bernath, Spectra of Atoms and Molecules (Oxford University Press)
Townes Schawlow, Microwave Spectroscopy (Dover Publications)
Engelke, Aufbau der Moleküle (Teubner)

Organization

The Secondary AoS Molecular Physics is composed of:

1. Molecular Physics I (3+1 hpw)
2. Molecular Physics II (3+1 hpw) or a specialized course (2 hpw) in Molecular Physics or Astrophysics

Examinations

The module is passed by passing an oral examination covering the topics of all attended courses. To be admitted to the exam, students must actively participate in the problem sessions (including the solution of homework problems). The grade given for the module is equal to the grade of the oral examination.

Aims
In the first part of the core courses the students learn the main concepts of molecular physics: separation of electronic, vibrational and rotational motion. Simple molecular spectra can be analyzed on the basis of the problem class. Fundamental group theory is used to predict vibrational and rotational spectra of more complex molecules.
In the second part of the core courses more complex issues of molecular spectra are introduced. The students will be enabled to analyze spectra of complex molecules which are subject to couplings between electronic, vibrational and rotational motions.
In the special courses basic and advanced molecular physics are applied to atmospherical and astronomical environments. This module prepares for topics of current research in molecular physics.

Prerequisites for Participation
None

Prerequisites
Atomic Physics, Molecular Physics and Quantum Mechanics at the level of the bachelor courses in physics

Frequency
Molecular Physics I is offered in the winter term, Specialized Courses are offered alternating.

Soft Skills
None

Use in Other Courses of Study
As elective subject in other M.Sc. programs

Coordinators
S. Schlemmer