

**Module: Specialization I**

Module No.: physics610

**Course:****Molecular Physics I**

Course No.:

Category	Type	Language	Teaching hours	CP	Semester
Elective	Lecture with exercises	English	3+1	6	WT

**Requirements:****Preparation:**

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

**Form of Testing and Examination:**

Oral Examination

**Length of Course:**

1 semester

**Aims of the Course:**

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.

This module prepares for topics of current research in molecular physics and provides the basis for the preparation of the master thesis.

**Contents of the Course:**

- Basics of molecular spectroscopy, phenomenology, diatomic molecules
- Born-Oppenheimer Approximation, separation of rotation and vibration
- Molecular Dipole moment and rotational transitions
- Rotational spectra and the rigid rotor approach
- Selection rules, parallel and perpendicular type spectra
- Nuclear spin statistics
- Hyperfine structure of molecular lines

**Recommended Literature:**

Bernath, "Spectra of Atoms and Molecules", Oxford University Press)  
 Townes Schawlow, "Microwave Spectroscopy" (Dover Publications)  
 Gordy & Cook, "Microwave Spectra" (Wiley)  
 Engelke, "Aufbau der Moleküle" (Teubner)  
 P. R. Bunker and Per Jensen: "Molecular Symmetry and Spectroscopy, 2nd Edition", ( NRC Research Press, Ottawa)