Concepts of Spectroscopy 2 (iMOS)

Module	Credits	Workload	Term	Frequency	Duration
8 RC	9 CP	270 h	2. Semester	Each SuS	1 Semester

Courses	Contact hours	Self-Study	Group size
a) Lectures b) Exercises c) Integrated laboratory practical	a) 2 SWS b) 1 SWS c) 5 SWS	120 h	a+b) 20 - 50 c) 5-20 Students

Prerequisites

a, b, c) Advanced knowledge in quantum chemistry, quantum mechanics and spectroscopic techniques, such as provided by the modules Concepts of Spectroscopy 1 and Dynamics and Simulation.
c) Admission to M.Sc. iMOS

Learning outcomes

After successful completion of the module/course, students will be able to:

- Obtain theoretical and practical knowledge of nonlinear optics important for non-linear spectroscopic and microscopic techniques to investigate structure, dynamics and interactions of chemical and biochemical samples
- Understand practical laser spectroscopic techniques in the lab course and their application in ongoing research projects through a hands-on approach
- Write reports with theories, experiments, and discussion of results
- Develop presentation skills in front of an audience
- Utilize digital techniques to prepare and conduct a presentation

Content

- Principles of non-linearity: Electromagnetic waves in vacuum and in matter, Non-linear responses, Anharmonic oscillator model, Phase matching, Higher order processes
- Non-linear spectroscopy techniques: SFG, SHG, Time-resolved spectroscopy
- Non-linear microscopy techniques: Confocal microscopy, Fluorescence microscopy, Super-resolution microscopy, Multi-photon microscopy methods, Scanning methods.

Teaching methods

a+b) Active participation during lectures and exercises with problems for self-studying, Q&A and discussion sessions with presentations given by the participants, Moodle course with online material.
c) Hands-on laboratory projects to be done in supervised sessions

Mode of assessment

a + b) 20 - 40 min end-of-term oral exam or 2-hour end-of-term written exam on the content of the lectures
c) graded lab reports handed in during the term on the integrated practical

Requirement for the award of credit points

a+b) Passing the written examination
c) successful acceptance of lab reports

Module applicability

a+b+c) M.Sc. iMOS; a+b) M.Sc. Chemistry, M.Sc. Lasers and Photonics

Weight of the mark for the final score

Weighted according to CPs
iMOS: CP-weighted average of the exam (5 CP) and the lab report (4 CP) grades according to the

examination regulations
Module coordinator and lecturer(s) P. Petersen Lecturers from Physical Chemistry departments
Further information