Molecular photophysics, 6.0 credits

Molekylär fotofysik, 6.0 hp

Third-cycle education course

6FIFMB0

Department of Physics, Chemistry and Biology

Valid from: Second half-year 2025

Approved by **Approved**

Registration number

Entry requirements

Entry requirement for studies on third-cycle education courses

- second-cycle degree,
- 240 credits in required courses, including at least 60 second-cycle credits, or
- acquisition of equivalent knowledge in some other manner

Specific entry requirements for this course:
Basic knowledge of modern physics and/or chemistry.

Specific information

Molecular (organic) materials underpin a wide range of scientific areas, ranging from organic photovoltaics and light-emitting diodes, to human vision and photosynthesis. The thing that links this diverse range of topics is the interaction between the molcular material and light. This course aims to provide a comprehensive overview of the rich and varied photophysics of molecular materials, beginning at the quantum-mechanical level, before extending into the the spectroscopic techniques used to study them and their real-world applications.

Learning outcomes

By the end of the course the students will be able to:

- Understand and explain the theory and underlying principles of light absorption and emission in molecular organic materials.
- Describe quantum-mechanical spin and its role in the photophysics of organic molecules.
- Explain how vibrational couplings impact the specral shape of the absorption and emission.
- Comprehend the origin and importance of non-radiative transitions.
- Understand energy and electron transfer processes in donor-acceptor systems.
- Understand the spectroscopic techniques used to study organic photophysics, including steady-state and time-resovled absorption and emission spectroscopy.
- Describe the applications of photo-active organic molecules, including in photovoltaics and light-emitting diode devices.

Contents

The course lectures will cover topics including: the electronic structure of molecular organic materials, light-matter interactions, excitons and spin, radiative and non-radiative transitions, energy and electron transfer, steady-state and time-resolved optical spectroscopy, organic photovoltaics, and organic light-emitting diodes.

Educational methods

The teaching will consist of lectures and student-led seminars.

Examination

Oral examination in the form of a seminar where the students will present a paper from the broad literature related to molecular photophysics. The aim is to discuss the findings of the paper in the context of the learning outcomes of the course.

Grading

Two-grade scale

Course literature

Electronic Processes in Organic Semiconductors: An Introduction.
Anna Köhler, Heinz Bässler
(Print ISBN:9783527332922; Online ISBN:9783527685172;
DOI:10.1002/9783527685172)
Modern Molecular Photochemistry of Organic Molecules.
Nicholas J. Turro, V. Ramamurthy, J. C. Scaiano
(ISBN: 9781891389252)

General information

The course is planned and carried out according to what is stated in this syllabus. Course evaluation, analysis and suggestions for improvement should be fed back to the Research and PhD studies Committee (FUN) by the course coordinator.