Photophysics and Photochemistry

SCHOOL
Faculty of Science

CAMPUS
Belle-Beille

LEVEL
2nd year Master's degree

OPEN TO EXCHANGE STUDENTS
Yes

SEMESTER
Fall (S1)

- **Degree course:** Light, Molecules, Matter
- **Teaching unit:** UE4
- **Course language:** English
- **Duration (hours):** 30
- **ECTS:** 2
- **Teacher(s):** Matthieu LOUMAIGNE

Assessment:

- [x] Continuous assessment
- [ ] Final exam

Teaching methods:

[x] Lecture course	17	hours	[ ] Case study
[x] Tutorial course	5	hours	[ ] Project
[x] Practical work	8	hours	

COURSE DESCRİPTİON

- Basic characteristics of light sources (intensity, spectrum, polarization, coherence, etc.) and basic physics principle of light emission (black body, spectral lamp, LED, laser, etc.).
- Basic understanding of the physics principles of light-matter interaction (light scattering and absorption).
- Reminders on the concepts seen in M1 of the Jablonski diagram, quantum efficiency and fluorescence lifetime.
- Measure and analysis of fluorescence decays (TCSPC method).
- Dynamic and static quenching of fluorescence (Stern-Volmer model).
- Introduction to solvatochromic effects and fluorescence anisotropy.
- Nonlinear polarisation of light: effects and applications.
- Engineering of Molecules for Second-Order Nonlinear Optics.
- Light-absorption and Electron-transfer: Marcus theory and «optical» electron-transfer vs. photoinduced-electron transfer (PET).
- Introduction to mixed-valence complexes and molecular wires.
- Other applications of PET.
- Photoinduced energy transfer, theories of Förster and Dexter. Molecular examples with systems applied to amplify light harvesting.
- Artificial photosynthesis, basic concepts, molecular and hybrid systems for the conversion of sunlight into chemical potential.

OBJECTİVES

This course aims at developing further the concepts seen in M1 on the fundamentals and application of photophysics. The main objective is to give to chemist students a training base for tackling theoretical models from scientific literature and understanding the link between the chemical and electronic structure of a molecule and its optical and photophysical properties.

The main notions of photochemistry, photophysics (including basics of nonlinear optics, electron and energy transfer) and their application to biological photosynthesis, and artificial photosynthesis will be taught.