

CH-442

## Photochemistry I

Moser Jacques-Edouard

| Cursus    | Sem. | Type |
|-----------|------|------|
| Chimie    | BA6  | Opt. |
| HES - CGC | E    | Obl. |

|              |                 |
|--------------|-----------------|
| Language     | English         |
| Credits      | 3               |
| Session      | Summer          |
| Semester     | Spring          |
| Exam         | Oral            |
| Workload     | 90h             |
| Weeks        | 14              |
| <b>Hours</b> | <b>2 weekly</b> |
| Lecture      | 2 weekly        |

### Summary

This course presents the theoretical bases of electronic spectroscopy and molecular photophysics. The principles of the reactivity of excited states of molecules and solids under irradiation are detailed. The main classes of industrial and natural photochemical processes are finally described.

### Content

#### 1. Fundamentals

Introduction - Light absorption and reflection - Radiation and molecular orbitals - Photonics of solid materials.

#### 2. Photophysical processes

Excited states deactivation pathways - Kinetics of radiative and nonradiative processes - Excimers and exciplexes - Intermolecular electronic energy transfer - Photosensitization.

#### 3. Photochemical reactions

Photodissociation - Multiphoton processes - Photoinduced electron transfer - Pericyclic concerted reactions.

#### 4. Organic synthetic reactions

Reactions of ethenes and aromatic compounds - Photo-chemical reactions of the carbonyl chromophore - Photo-oxygenation (singlet oxygen, superoxide anion).

#### 5. Polymer and pigments photochemistry

Photopolymerization and cross-linking - Photodegradation and stabilization of polymers and pigments.

#### 6. Natural photochemical processes

Light-induced atmospheric reactions - Natural photosynthesis - Mechanisms of vision.

### Keywords

Electronic spectroscopy, Molecular photophysics, Photoinduced electron transfer, Organic photochemistry, Singlet oxygen, Polymer photochemistry, Natural photochemical processes

### Learning Prerequisites

#### Required courses

Quantum mechanics and molecular spectroscopy

### Learning Outcomes

By the end of the course, the student must be able to:

- Formulate the macroscopic and quantum laws of the absorption of light by molecules and solids
- Describe the various deactivation processes of molecular excited states
- Characterize the kinetics of deactivation processes and their role in the photochemical reactivity

- Quote the various types of photochemical reactions
- Explain the basic principles of the thermodynamics and kinetics of photoinduced electron transfer
- Describe the photochemical reactivity of ethenes and carbonyl compounds
- Discuss the properties and reactivity of singlet oxygen and ways to prepare it
- Express the principles of photopolymerization and polymer photodegradation and stabilization
- Represent the mechanisms of natural photochemical processes

## Resources

### Ressources en bibliothèque

- [Modern molecular photochemistry of organic molecules / Turro](#)
- [Photochemistry and photophysics : concepts, research, applications / Juris](#)
- [Principles of molecular photochemistry : an introduction / Turro](#)
- [Principles and applications of photochemistry / Wardle](#)

### Notes/Handbook

All copies of the slides are available in pdf format on the course's web pages

### Websites

- <http://photochemistry.epfl.ch/PC.html>

### Prerequisite for

CH-443 Photochemistry II