Photophysique et photochimie

Niveau d'étude
BAC +5 / master

ECTS
2 crédits

Composante
Faculté des sciences

En bref

- Langue(s) d'enseignement: Français
- Ouvert aux étudiants en échange: Oui

Présentation

Description

Basic characteristics of light sources (intensity, spectrum, polarization, coherence, ...) and basic physics principle of light emission (black body, spectral lamp, LED, laser, ...).
Basic understanding of the physics principles of light-matter interaction (light scat-tering and absorption).
Reminders on the concepts seen in M1 of Jablonski diagram, quantum efficiency and fluorescence lifetime.
Measure and analysis of fluorescence decays (TCSPC method).
Dynamic and static quenching of fluorescence (Stern-Volmer model).
İntroduction 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-trans-fer vs. photoinduced-electron transfer (PET).
İntroduction 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.

Objectifs

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 understan-ding 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, of electron and energy transfer) and their application to biological photosynthesis, and artificial photosynthesis will be taught.

Heures d'enseignement

CM	Cours magistral	17h
TD	Travaux dirigés	5h
TP	Travaux pratique	8h

Pré-requis obligatoires

Compétences visées

This course, mainly intended to synthetic chemists, aims to teach the principles of the formation of excited states under UV-visible
radiation. İt should enable them to assess the reactivity of excited states and their monomolecular (photophysical) evolution as well as their transformations by bimolecular interactions. The students should be able, in fine, to use the basic principles pertaining to interactions between light and molecules, taught in this course, to usefully design molecular systems adapted to a given task. This means:
— Mastering the representation and properties of photo-excited states, relaxation processes and physico-chemical properties of excited states.
— Use of fluorescence and Stern-Volmer processing as well as notions of quantum fluorescence yield to help decipher the mechanisms of electron or energy transfer. The latter are related to the conservation theory of orbital symmetry.
— Mastering basic notions to design NLO-active (hyperpolarisable) molecules.
— Mastering the photoinduced electron-transfer and energy transfer phenomena, inclu to electron-transfer with a special emphasis to donor-acceptor systems.
— Knowledge on the different approaches to realize artificial photosynthesis and associated processes.
› Experimental lab – 8h
— Basic optical experiments in order to illustrate the notion of polarization of light.
Application to polarized microscopy.
— Basic optical experiments on diffraction in order to illustrate the working principle of spectrophotometer and monochromator.
— Measurement of the spectra of several light sources.
— Halide (Cl-) quenching of quinine sulfate fluorescence.
— Fluorescence lifetime measurement and analysis.
— Brève introduction à la microfluidique pour la manipulation des fluides in situ avant leur caractérisation.

İnfos pratiques

Lieu(x)

› Angers

Campus

Campus Belle-beille