Application deadline: 30/04/2023

PhD student position on the project
"Ultrafast Investigation of Anti-Kasha Photochemical Reactions in Molecular Systems"

Context

The Kasha's rule is a fundamental principle of photophysics and photochemistry stating that photoinduced reactions in polyatomic molecules in the condensed phase occur with appreciable yield only in the lowest excited state of a given multiplicity, irrespective of the excitation wavelength. Its implications touch any aspect of photochemistry and photophysics and set severe limitations, for instance, to the efficiency of solar energy conversion by photovoltaic or photosynthetic systems, or to controlling, and not only triggering, a chemical reaction with light. It stands against the fabrication of multiresponsive materials, *i.e.* whose response could depend on the photon wavelength or on the number of excitations. Nevertheless, evidence of its violation has been reported for the major types of excited-state reactions, arousing a growing interest in anti-Kasha (aK) photo-physics and -chemistry. A huge potential could be unleashed by increasing the number of chromophores for aK applications and, after a better comprehension of the fundamental mechanisms, learning how to design them. Indeed, a deep understanding of the fundamental mechanisms underneath aK photochemistry and designing more aK chromophores would open up an unexpectedly broad range of possibilities for selective control of photochemical reactions, and not only the reduction of energy losses in photonic devices. The aim of the project is to achieve such a keen understanding by means of state-of-the-art ultrafast electronic spectroscopies, complemented by molecular dynamics simulations.

Assignment

We are offering a fully funded position as a doctoral fellow (PhD student) in our group at the Institute of Applied Physics of the University of Bern (Switzerland) to develop an innovative experimental approach where femtosecond time-resolved coherent electronic spectroscopies (Fourier transform four wave mixing spectroscopy or, shortly, 2D photon-echo), vibrational and x-ray spectroscopies are combined with advanced non-adiabatic molecular simulations to investigate several molecular systems showing an exploitable anti-Kasha behaviour, from their earliest dynamics to the final product. This integrated approach will open the way to a deeper comprehension of the mechanisms underlying multi-response materials with the long-term prospect to manipulate such a kind of phenomena. This is a challenging and stimulating task where different experimental techniques must be mastered and synergistically coupled. As a chosen candidate, you will be completely involved in this research project being part of a team with complementary experimental and theorical competences. Your main goal will be to the develop and implement several cut edge table-top experimental set-ups and to apply it to the study of different phenomena in different molecular systems. These will include electron transfer and formation of charge separation states in metal complexes, excitonic couplings in antenna systems, photo-induced structural and dynamical modifications in photosensors and macromolecules.

Your Profile

We are seeking for a motivated researcher with a strong background in molecular physics, physical chemistry or laser physics and a strong interest in one or more of the following fields: coordination chemistry, lasers, nonlinear optics, femtosecond spectroscopy, light-matter interaction, theoretical chemistry. You should have an active attitude, an accurate way of working, and excellent communicative and collaborative skills.
The research activity will have a strong experimental character with a clear focus on fundamental aspects of molecular science. Graduate students with a diploma or master degree in Physics, Chemistry, or closely related subject, are welcome to apply.

The appointment is immediately available. The salary is based on the salary scale of the Swiss National Science Foundation (indicatively 40'000 CHF/year). The employment rate is 100 % for 4 years.

To apply

Your application should consist of:

- A cover letter, emphasizing your specific interest, qualifications, and motivation to apply for this position.
- A full Curriculum Vitae, including a list of all courses and grades obtained.
- A short description of your MSc research.
- Reference letters and contact information of two scientific staff members.

For further information contact prof. Andrea Cannizzo (Andrea.Cannizzo@iap.unibe.ch)