Postdoctoral position in 2DIR spectroscopy in flavoenzymes (Ecole polytechnique, France)

A postdoctoral position is available at Laboratoire d'Optique et Biosciences (Ecole Polytechnique, CNRS, INSERM) in Palaiseau, France. The proposed appointment is for a duration of at least 18 months, with a starting date flexible between September 2021 and January 2022. The hired postdoc will contribute to the MIRTHYX project (ANR-19-CE30-0001), aimed at developing 2DIR spectroscopy in flavoenzymes, in close collaboration with Institut d'Optique Graduate School and Amplitude Laser.

Laboratoire d'Optique et Biosciences (LOB) benefits from a cross-disciplinary environment where physicists and biologists work together in order to address relevant issues in biology through the development of new optical methods, based for example on femtosecond lasers and nonlinear optics. In this context, the host team is more particularly involved in the application of mid-infrared (MIR) femtosecond spectroscopy to the investigation of various biomolecules [1-4]. The proposed project will address the local structural changes of the flavoenzyme ThyX upon binding of substrates or inhibitors. ThyX, a bacterial alternative to Thymidylate Synthase, has been identified as a promising antimicrobial target [5]. Unnatural amino acids will be inserted at specific sites of the protein in order to provide a combined spatial and temporal resolution. The application of 2DIR spectroscopy to this system will be only possible thanks to the great enhancement in signal to noise ratio recently reported for diode-pumped high rep-rate 2DIR spectrometers [6-8]. The MIR source developed during the MIRThyX project will take advantage of the recent demonstration by our partners of efficient compression down to 7 fs pulses [9], greatly simplifying the generation of MIR pulses through the use of mere optical rectification.

The hired post-doc will have the opportunity to contribute to the following tasks:
- preparation of ThyX proteins with unnatural amino acids substituted at appropriate sites,
- MIR pump-probe spectroscopy in ThyX using a 1-kHz Titanium:Sapphire system,
- development of a new scanning 2DIR spectrometer suitable for 125-kHz operation,
- characterization of the 125-kHz MIR source based on optical rectification of 7-fs pulses,
- 2DIR spectroscopy in ThyX using the 125-kHz MIR source.

The last two items will take place at Institut d'Optique, located in Palaiseau at a walking distance from LOB.

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[3] J.A. De La Paz, A. Bonvalet, M. Joffre, Opt. Express 27, 4140 (2019).
[4] D. Sorigué et al., Mechanisms and dynamics of fatty acid photodecarboxylase, Science (in press, 2021).
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[6] B.M. Luther, K.M. Tracy, M. Gerrity, S. Brown, A.T. Krummel, Opt. Express 24, 4117-4127 (2016).
[7] P.M. Donaldson, G.M. Greetham, D.J. Shaw, A.W. Parker, M. Towrie, J. Phys. Chem. A 122, 780-787 (2018).
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[9] L. Lavenu, M. Natile, F. Guichard, X. Delen, M. Hanna, Y. Zaouter, P. Georges, Opt. Express 27, 1958-1967 (2019).

For more information, please feel free to contact Manuel Joffre (manuel.joffre@polytechnique.fr).

The application file will consist of a detailed curriculum vitae, a cover letter (including a short summary of your research experience), and the names and e-mails of three references. The url for uploading your application will be available here by mid-April. Applicants selected in the shortlist will be contacted for a remote interview that will take place in May or early June 2021.