ECOLE DOCTORALE : SDLM **PROPOSITION DE SUJET DE THESE**

Unité de recherche d'accueil

Unité de Recherche : Institut de Physique de rennes, UMR UR1-CNRS 6251 (IPR)

Equipe : Département Matériaux et Lumière

Encadrement

Directeur de thèse : Prof. Eric Collet | Unité : IPR UMR 6251 | % encadrement prévu (≥ 30%) : 50%

Employeur/Établissement d'origine : Université de Rennes 1

Confirmer HDR : X oui (attention, obligatoire !) | Nb de thèses en cours : 1

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Co-directeur de thèse : | Unité : | % encadrement prévu (≥ 30%) :

Employeur/Établissement d'origine :

Confirmer HDR : □ oui (attention, obligatoire !) | Nb de thèses en cours :

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Co-encadrant de thèse : Dr Roman Bertoni | Unité : IPR UMR 6251 | % encadrement prévu (≥ 30%) : 50%

Employeur/Établissement d'origine : Université de Rennes 1

HDR : □ oui X non | Nb de thèses en cours : 0

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Financement

Premier organisme : Université Rennes 1 | Pourcentage : | Financement : X acquis □ en cours de demande

Deuxième organisme : | Pourcentage : | Financement : □ acquis □ en cours de demande

Sujet

Titre : Ultrafast photoinduced phenomena in magnetic charge-transfer systems

Mots clés : Materials, Photoinduced phase transitions, Ultrafast dynamics, spectroscopies, synchrotron, X-FEL

Descriptif :
A 3-year PhD fellowships available at the Physics Institute of University Rennes 1, France. The research activity of the hosting group, Materials and Light Department, is focused on *photoinduced phase transitions and their multiscale dynamics in molecular materials* of which functionalities (magnetic susceptibility, electric conductivity, both) are controllable by external stimuli, such as light, electric and elastic fields. We investigate photoswitching mechanisms by using the following femtosecond techniques: X-ray scattering and X-ray diffraction (at synchrotrons and XFELs), X-ray absorption (at XFELs) and Ultrafast UV/VIS/IR spectroscopy (in house lab).
This PhD project is about Ultrafast photoinduced phenomena in magnetic charge-transfer systems (Co-Fe, or Co-W) forming 0D, 1D, 2D or 3D polymers. These bistable system scan switch by light irradiation between diamagnetic and para/ferromagnetic states [1,2]. The goal of the project, developed in the framework of the international laboratory (LIA) France-Japan IM-LED (http://www.chem.s.u-tokyo.ac.jp/users/lia_im-led/index-e.html) is to control by light the magnetic state of the system around two main lines:
-1 Ultrafast dynamics at femtosecond timescale: what is the basic mechanism, how electronic and structural degrees of freedom are involved? To answer this question, we will use femtosecond spectroscopy available at the Institut de physique de Rennes, as well as femtosecond XANES at X-ray free electron laser [3,4].
-2 Elastic cooperativity: upron molecular volume change, cooperative molecular switching occurs in materials, as recently demonstrated [5]. We want to use this new physical process to reach high control in charge-transfer magnetic materials.

[1] N. Ozaki, H. Tokoro, Y. Hamada , A. Namai , T. Matsuda , S. Kaneko, Sh. Ohkoshi. ***Adv. Funct. Mater.*** 22, 2089 (2012)
[2] Y. Miyamoto, T. Nasu, N. Ozaki, Y. Umeta, H. Tokoro, K. Nakabayashi and S. Ohkoshi. ***Dalton Trans.*** 45, 19249 (2016)
[3] M. Cammarata, R. Bertoni, M. Lorenc, H. Cailleau, …, E. Collet. ***Phys. Rev. Lett.*** 113, 227402 (2014)
[4] H. T. Lemke, …, E. Collet, Marco Cammarata. ***Nature Commun.*** DOI: 10.1038/ncomms15342 (2017)
[5] R. Bertoni, M. Lorenc, H. Cailleau, …, E. Collet. ***Nature Materials*** 15, 606 (2016)

http://blogperso.univ-rennes1.fr/eric.collet/ et site web du département Matériaux et Lumière à l'IPR

S'agit-il d'un projet de thèse en cotutelle internationale (oui/non) : non mais collaboration avec Tokyo (Japon)

Si oui, préciser l'établissement et le pays de rattachement :

Candidat

Profil du candidat recherché (**2-5 lignes**) :
Successful candidates will work in the ultrafast spectroscopy laboratory and participate in experimental campaigns on large facilities around the world (synchrotron, X-FEL) and in Tokyo in the frame of the France-Japan International Laboratory. Our team is young and dynamic, with a third being foreign English is the working language. Requirements: M.Sc. degree in physics material science or chemistry, good understanding of Physics / material science, good experimental skills, good team player.