Master M2

« Physique des Plasmas et de la Fusion »

Proposition de stage (5 à 6 mois à partir de mi-mars) **: oui**
Proposition de thèse : non

Date de la proposition :

Ne pas dépasser une page / Do not exceed one page

Responsable du stage ou de la thèse / *internship or PhD supervisor*:

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Nom du Laboratoire / *laboratory name*:

Code d'identification : LULI Laboratory
Organisme / *Institution* : CNRS/Ecole Polytechnique/CEA/Sorbonne Un.

Site Internet / *web site*:
Adresse / *address:* Ecole Polytechnique, 91128 Palaiseau CEDEX
Lieu du stage ou de la thèse / *internship or PhD place*: LULI

Titre du stage (de la thèse) / Microscopic characterization of glass GeO2 in Warm Dense Matter regime

Résumé / *summary*

The "Warm Dense Matter", defined by densities between 0.1 and 100 times the solid density, temperatures in the range 0.1 - 100 eV and pressures up to hundreds Mbar, is located in the phase diagram at the boundary between condensed matter and plasma physics. This zone appears as a critical zone because it is located where the so-called standard theories of condensed matter physics and statistical plasma physics are no longer valid. In this regime, plasmas are weakly ionized, strongly coupled and partially degenerate. No approximation is simple, making theoretical studies very complicated. This domain is encountered when one goes from a solid material to a plasma, a regime encountered in laser experiments (Inertial Confinement Fusion or high pressures materials science), but also in planetology and geophysics. Despite important progress obtained in the last 20 years on its macroscopic characterization (e.g. equations of state), microscopic studies are today necessary to investigate finely the WDM structure changes and the phase transitions.

In this context, we propose a stage on the phase diagram study of the laser shocked glass GeO2 in the Mbar pressures range.

GeO2 is an important material that can exist in three polymorphic phases at ambient conditions: quartz, rutile and glass. Its interest stems from similarities and differences with the ubiquitous SiO2. On one side GeO2 is considered a chemical and structural analogue of SiO2, a material of interest for planetology (i.e. the glass phase of GeO2 is used as a model for liquid SiO2), on the other side it exhibits less polymorphism, different optical properties and higher sensitivity to applied pressure, so that structural and electronic changes in GeO2 are expected at more moderate conditions. We already began to undertake an extensive study on glass GeO2 aiming at comparing its phase diagram under dynamic compression to the one reported under static compression, extending the knowledge of its phase diagram to more extreme conditions and comparing its behavior to SiO2 in particular regarding shock- induced recrystallization and metallization in the WDM regime. In our last campaigns laser-shock induced recrystallization of glass GeO2 was observed using online XRD and its EoS could be measured up to around 10 Mbar. During its internship, the student will analyze and interpret the data of the last experiment performed at LULI 2000 in September 2021. The student will use a numerical tool developed in Python language for X-ray diffraction data and hydodynamical code to simulate the pressure conditions achieved. This internship will be conducted in strong collaboration with R. Torchio and collaborators at ESRF in Grenoble.

Toutes les rubriques ci-dessous doivent obligatoirement être remplies
Ce stage pourra-t-il se prolonger en thèse ? *Possibility of a PhD* ? **: OUI** **Rémunération du stage/** *financial support for the internship* ***: OUI*** **Financement de thèse envisagé /** *financial support for the PhD* **:** **Type de stage et/ou de thèse (expérience/théorie/simulations) : expérience/simulation**

Fiche à transmettre (fichier pdf **obligatoirement**) à Catherine Krafft, catherine.krafft@universite-paris-saclay.fr
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