PhD position at the Institut Laue-Langevin in Grenoble and University of Silesia (Poland)

Fast and slow dynamics of glass-forming systems under confinement

The dynamics of soft matter confined at a nanometer length scale are much different from those observed in the bulk state. For glass-formers embedded in nanopores, one of the most characteristic signatures of confinement effects is faster dynamics and a more heterogeneous distribution of the relaxation time. Deviation from the bulk behavior is believed to originate from strong interactions with the confining surface, which results in vitrification of the molecules located close to the pore walls at a much higher temperature than that corresponding to the core fraction.

While the macroscopic structural relaxation in nanopores has been studied intensively for a variety of glass-forming systems by dielectric spectroscopy or calorimetry much less is known about the effect of geometrical confinement on the microscopic dynamics and the temperature range where the dynamics are faster.

The focus of this study is on understanding the behavior of fast and slow dynamics of glass-forming systems in the presence of two-dimensional nanoscale confinement. Cooperative molecular movements responsible for the glass transition are what we call slow dynamics, while the dynamics with the characteristic time on pico- or nanoseconds, i.e., many orders of magnitude shorter than that associated with the structural relaxation, are what we term fast dynamics.

The key questions to address
- *What is the effect of geometric confinement on molecular motions on the pico- to nanosecond time scale of glass-forming systems?*
- *Is there any connection between dynamic processes separated by many orders of magnitude, especially in the temperature region where the interfacial layer becomes frozen within the experimental timescale?*

Conditions

The student will be mainly based at the Institute Laue-Langevin (ILL) in Grenoble (France) but with few longer secondments at University of Silesia in Katowice (Poland). The student will be employed for three years on a French working contract at the ILL1 and enrolled at the Doctoral School of the University of Silesia as well. The exact plan of when to work where will be made with the student. The supervisors will be Prof. Karolina Adrjanowicz (University of Silesia, Poland) and Instrument Scientist Dr. Markus Appel at Institute Laue-Langevin (ILL, France).

Required qualifications

We are looking for a student with a master degree in physics or a related subject. A student with an experimental background (x-ray diffraction or neutron scattering) and experience with advanced data treatment (Python programming) is preferred. Additional knowledge of molecular dynamics simulations is an advantage.

How to apply

Send an email to Karolina Adrjanowicz (kadrjano@us.edu.pl) and Markus Appel (appel@ill.fr) with the subject “ILL PL PhD”. Attach a CV, master degree diploma (if already available), and a brief motivation letter. You are also welcome to contact us if you have any questions. This project is open for applications until 28 November 2025 and will be closed after this date as soon as a suitable candidate has been found.