LMS Seminar

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Modelling Plastic Deformation in Amorphous Solids

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ABSTRACT

Irreversible rearrangements on the particle scale are at the origin of permanent plastic deformations in solids. While our understanding of plasticity has made remarkable progress for crystals, it remains relatively modest for amorphous solids, however ubiquitous in our daily life: foams, gels, toothpaste, glasses, and granular media. The main reason for this uncomfortable situation comes from their disordered structure, preventing the identification of the elementary mechanisms of plastic deformation, such as dislocation glide in crystals.

Our numerical work addresses this challenge by developing a method to compute the local yield stress field in model glasses. This technique allows us to efficiently sample the local plastic rearrangement thresholds non-perturbatively, for different loading directions, and on well-controlled length scales. We show that this local yield stress method is highly helpful in capturing the barrier dependencies to glass preparation, shear banding, and induced anisotropy. It is, therefore, an ideal tool for documenting what happens “inside” an amorphous solid and better characterising the relationship between structure and plasticity. From a practical point of view, we show that it makes it possible to envision more quantitative multi-scale modelling strategies.

BIOGRAPHY

Sylvain Patinet is a CNRS researcher at PMMH (Physique et Mécanique des Milieux Hétérogènes) laboratory in ESPCI (École Supérieure de Physique et Chimie de la Ville de Paris). Prior to that,he obtained is PhD in solid-state physics at University Paris-SUD and was post-doctoral researcher at Johns Hopkins University. His research interests are related to the plasticity of crystalline alloys and glasses; the critical depinning transition studied at the atomic scale.