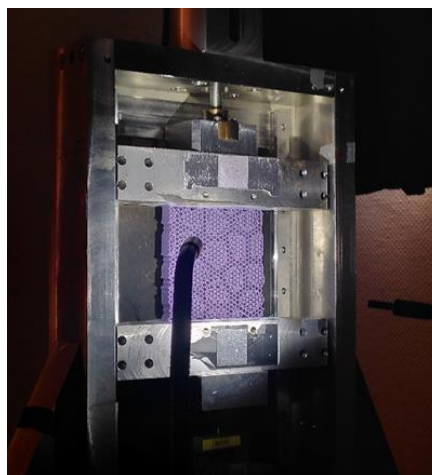
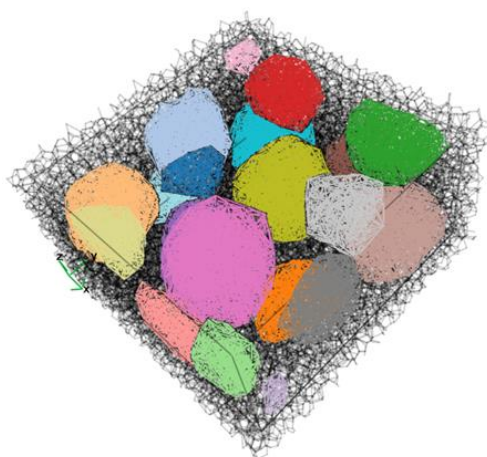


## INTERNSHIP OFFER

# Mechanical characterization of metamaterials with a composite architecture

To reduce both production costs and carbon footprint of technical materials, a choice method is to decrease the mass of the objects. A way to create such lighter materials which is highly studied in research is to replace usual technical materials with 3D-printed microlattices. These structures are extremely porous, and by playing on the spacial organization of the beams (the architecture of the metamaterial) we manage to reach spectacular rigidities that are much greater than the ones observed in other material of similar light weight such as aerogel or solid foams. The SPHYNX and LIONS groups at CEA have designed such a microlattice metamaterial with a random architecture that is perfectly isotropic, which enables the definition of standard material constants (Young's modulus, elastic limit, toughness). Furthermore, the rigidity-density ratio of this material is tending towards the theoretical limit for porous materials. However, this metamaterial remains fragile, and as such various methods of including heterogeneities in its structure are explored in order to toughen it.



**Gauche :** Représentation 3D d'un métacomposite. Les différents grains durs sont affichés en couleurs. **Droite :** Test préliminaire de compression axiale sur un métacomposite en quasi-2D

The aim of this internship is to characterize the deformation resistance and fracture toughness in tensile and compression tests of this so-called metacomposite, i.e. a microlattice metamaterial with zones of varying connectivity, which by design can create effective stiff grains and soft joints. Numerical testing may also optionally accompany this experimental research.

This internship project is mainly experimental, and will take place in Service de Physique de l'Etat Condensé (SPEC) of CEA Saclay de l'Université Paris Saclay, which is on the Orme des Merisiers center, 91191 Gif sur Yvette, France, in collaboration with the Nanosciences et Innovation pour les Matériaux, la Biomédecine et l'Énergie (NIMBE) laboratory of CEA Saclay. It unites researchers of various expertises. The candidate will need to integrate this consortium and interact with all members. The candidate will benefit from a stringly pluridisciplinary supervising, implicating expertises from physics, chemistry, and structure and material mechanics. The project can be pursued into a PhD on a tangential subject.

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