INTERNSHIP PROPOSAL

Laboratory name: IPGP, Université Paris Cité
CNRS identification code: UMR 7154
Internship director'surname: LANDEAU Maylis, co-advisor: LIMARE Angela
e-mail: landeau@ipgp.fr, limare@ipgp.fr
Web page: https://www.ipgp.fr/~landeau/
Internship location: 1, rue Jussieu, 75005 Paris

Thesis possibility after internship: YES
Funding: Funding for internship If YES, which type of funding: IPGP

Mixing of a stable stratification by a planetary collision

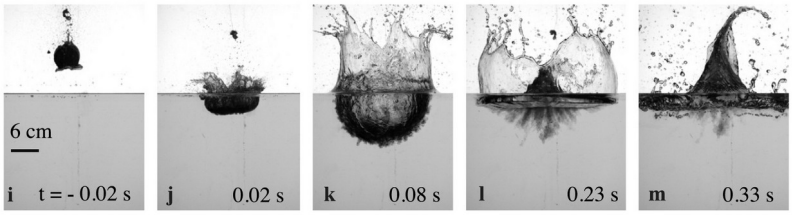

Figure 1: Impact of a liquid volume into a lighter miscible liquid (Landeau et al., 2021)

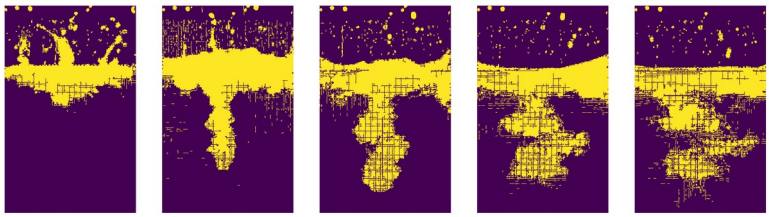

Figure 2: Impact of a liquid into a linearly stratified liquid (Maller, PhD thesis)

The Earth formed 4.5 billion years ago by high-energy collisions between planetary embryos. Each Earth-forming impact induced shock waves that melted the colliding embryos, bringing these events into the realm of fluid mechanics (Landeau et al. 2021, Maller et al. 2024). The student will use laboratory experiments (figure 1) to investigate the dynamics of these giant planetary collisions.
Current models of planetary accretion suggest that the core and the mantle of the Earth were stratified in composition after their formation. Whether the last impact that formed the Earth and its Moon mixed and homogenized this stratification remains debated. This question is critical for the origin of the primordial heterogeneities in Earth's mantle that are inferred from geochemical observations.

The successful candidate will conduct experiments on the impact of a liquid volume into a pool of a linearly stratified liquid (figure 2). They will record the flow on a high-speed camera and characterize the turbulent mixing using laser-induced fluorescence and conductivity probes. Using scripts in Python, the student will estimate the mixing efficiency as a function of the ratio of the stratification strength to the impact speed. These results will provide key constraints on the primordial stratification of Earth's mantle.

We are looking for a master student (first or second year) in physics, engineering, mathematics or Earth sciences, motivated to work in the lab, with a solid background in physics, and programming skills in Python.

Please, indicate which speciality(ies) seem(s) to be more adapted to the subject:

Condensed Matter Physics: NO Soft Matter and Biological Physics: YES
Quantum Physics: NO Theoretical Physics: YES