# A Lagrangian particle framework in a GPU accelerated Eulerian code

Clément Robert*[1]

[1]Institut de Planétologie et dÁstrophysique de Grenoble – observatoire des sciences de l'univers de Grenoble – France

**Résumé**

Idefix is a GPU accelerated Eulerian framework to solve Magneto-Hydrodynamics (MHD) problems. In essence, it resolves the dynamics of a homogenous (ionized) gas mixture. However, In astrophysical applications (e.g. dynamics of the interstellar medium, stellar accretion, planetary formation, ...), solids (dust) often play a crucial role in the dynamics.

Even if the solid-to-gas mass ratio is, on average, close to negligible (1%), dust dominates thermal radiation and as such, contributes most of the observable signals from astronomical targets such as proto-planetary disks. In regions most prone to host planetary formation, dust tends to accumulate and the solid-to-gas ratio gets close to, or greater than 1, so it cannot be neglected.

It is then paramount to be able to accurately simulate the interplay of gas and solids in order to study planetery formation and the hydrodynamical instabilities that lead there.
I will present a new module I developed for Idefix, in which the dynamics of gas-dust interactions is resolved and dust is treated as a cloud of Lagragian particles.
I will illustrate how we overcome specific implementation challenges regarding grid/particles interactions and how we use the Kokkos C++ library to leverage GPU performance. I will discuss physical tests and runtime performances.

*Intervenant