Dust Grains Evolution by chemical sputtering during protostar formation

Antonin Borderies [1], Benoît Commerçon [1], Bernard Bourdon[2]

[1] *CRAL, ENS Lyon*

[2] *LGL-TPE, ENS Lyon*

To model accurately the protostar formation by gravitational collapse, one needs to take into account many physical ingredients such as radiative transfers or the magnetic field. Both of them greatly influence the mixture of gas and dust that is collapsing, but the opposite is also true. For example, the dust quantity and size distribution will change the opacity and the black body emission of the medium, and it will greatly influence the non-ideal MHD resistivities, which are not negligible during the gravitational collapse.

Thus, modeling accurately the evolution of the dust grain size distribution is fundamental to model and understand correctly the protostar formation. In particular, the dust evaporation by chemisputtering when the temperatures reach 600 K seems to produce an out-of-equilibrium evolution of the dust grains (Lenzuni et al. 1995), which has not been taken into account in collapse simulations for now.

In this presentation, we will present how to model accurately this process of evaporation by chemisputtering during the gravitational collapse. We will use temperature and density trajectories of dust grains from an hydrodynamical simulation from Bhandare et al. (2024) to compute the evolution of a dust distribution. Then, we will present the impact on the resistivities and the opacity. Details of this work can be found in Borderies et al. (2025).