

3D interstellar chemo-physical evolution (3DICE)

V. Wakelam^{1,2}

¹ *Univ. Bordeaux, LAB, UMR 5804, F-33270, Floirac, France*

² *CNRS, LAB, UMR 5804, F-33270, Floirac, France*

Carbon and heavier atoms are born in the centre of stars. At the end of their life, stars spread their inner material into the diffuse interstellar medium. This diffuse medium gets locally denser and form dark clouds (also called dense or molecular clouds) whose innermost part is shielded from the external UV field by the dust, allowing for molecules to grow and get more complex. Gravitational collapse occurs inside these dense clouds, forming protostars and their surrounding disks, and eventually planetary systems like (or unlike) our solar system. The formation and evolution of molecules, minerals, ices and organics from the diffuse medium to planetary bodies, their alteration or preservation throughout this cosmic chemical history set the initial conditions for building planets, atmospheres and possibly the first bricks of life.

The evolution of the gas and dust chemical composition during this sequence is a continuous process in the sense that the chemical composition never reaches steady-state. The chemical composition in one of the steps then depends on the previous ones. The current view of interstellar chemistry is, however, based on fragmental works on key steps of the sequence that are observed. Astrochemists develop models to study the chemical composition of dense clouds, protostars or protoplanetary disks assuming the initial condition from the previous step and use the physical conditions observed in the present objects.

The objective of this project, funded by an ERC Starting Grant, is to follow the fractionation of the elements between the gas-phase and the interstellar grains, from the most diffuse medium to protoplanetary disks, in order to constrain the chemical composition of the material in which planets are formed. The potential outcome of this project is to get a consistent and more accurate description of the chemical evolution of interstellar matter.

