Gas phase Elemental abundances in Molecular cloudS (GEMS)

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Simulations with an increasing level of complexity are being developed to model the chemistry and dynamics of collapsing clouds. The pioneering one-dimensional models have been overtaken by three-dimensional magnetohydrodynamical (3D-RMHD) codes coupled with full gas-grain chemistry to simulate the complex process of cloud collapse. But all these sophisticated simulations share the problem of the uncertain initial conditions (turbulence, ionization degree, elemental abundances, magnetic field, geometry). Until now, most simulations adopt standard values that do not properly account for the different environments and star formation modes (isolated vs clustered). Our project aims at determining the S, C, N, O elemental abundances and the gas ionization fraction as a function of visual extinction in a selected set of prototypical star forming regions. These initial parameters determine the cloud evolution and star formation activity and, hence, are the essential ingredients of any 3D-R(M)HD simulations. It will also provide a high sensitivity and complete molecular database in a large sample of star forming clouds with great potential for progress in our knowledge of the evolution of the gas and ice chemical composition from the diffuse cloud to the prestellar core phase.