STAR FORMATION IN THE MILKY WAY : FROM CLOUDS TO PROTOSTARS

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Star forms in giant molecular clouds which exhibit turbulent motions and magnetic fields. Understanding how fast and how efficiently these molecular clouds convert diffuse gas into stars is key to better constrain the impact of star formation on galactic evolution. Second, we need to understand the origin of the stellar initial mass function (IMF) in order to calibrate star formation sub-grid models at galactic scales. When stars form, they inject energy and momentum in their surrounding via various stellar feedback processes : jets and outflows, stellar winds, radiation and eventually supernovae explosion. Together with magnetic fields and turbulence, all these feedback processes are expected to play an important role in the establishment of the stellar IMF. Last, at the scales of individual protostars, protostellar disks, the precursors of protoplanetary disks, are forming and trigger planet formation, which potentially connects planet formation to galactic evolution through star formation.

I will review our current understanding of star formation within molecular clouds, starting from the large scales (molecular clouds formation) down to the protostellar scales (cloud collapse). I will illustrate how fundamental problems of star formation (star formation rate and efficiency, IMF) can be better understood thanks to numerical experiments. I will finally conclude by recalling what are the main challenges left to future numerical experiment developments.