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PhD Dissertation

The early phase of Star Formation

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Abstract

Molecular clouds are the coldest and the densest part of the Interstellar Medium and are the sites of star formation.

Several observations have revealed the complexity of their internal constitution and dynamics: the infrared satellite Herschel, for example, has shown that molecular clouds are made by networks of intertwined filaments. It has been also possible to compare the morphology of the Galactic large-scale magnetic field (from the polarized emission of interstellar dust), revealing the close connection between the two components [1].

When the individual filaments composing a molecular cloud accumulate enough mass per unit length (by accretion from the ambient medium), they become gravitationally unstable and fragment into cores, that eventually collapse into stars and stellar clusters.

However, only 2-3% of the mass of molecular clouds is turned into stars in a free-fall time and this naturally leads to the problem of what physical processes supports them against gravity.

Large-scale magnetic fields and the turbulence of the interstellar gas are two natural candidates for providing support to the clouds. [2] Numerical simulations of the hydrodynamical (HD) or magneto-hydrodynamic (MHD) equations are the only 'experiments' we can use to probe the structure and evolution of molecular clouds in the presence of magnetic fields and gas turbulence.

In this seminar I will describe the process of star formation and recent advances in the global understanding of this process.

References

[1] André, P., Francesco, J. D., Ward-Thompson, D. et al., 2014, in Beuther, H., Klessen, R. S., Dullemond, C. P., & Henning, T., eds, Protostars and Planets VI. Univ. Arizona Press, Tucson

[2] Hennebelle and Falgarone, Astron. Astrophys. Rew., 2012, 20, 1



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