Spiral structure and gravitational instabilities in protostellar discs

Giuseppe Lodato (Universita' degli Studi di Milano)

During the earliest phases of their evolution, the gaseous and dusty discs that surround newly born stars can be relatively massive, compared to the central star. While in most cases their mass is not high enough to produce sizable deviation from Keplerian rotation (with some significant exceptions), they are certainly massive enough to be subject to gravitational instabilities and potentially display a large scale spiral structure. Unlike in galaxies, though, the collisional nature of the system leads to the development of shocks, that limit somewhat the propagation of density waves over large distances. In this talk I will review the current status of hydrodynamical simulations of protostellar discs including self-gravity. I will first focus on the issue of the conditions under which a local model (which is appropriate when the waves cannot travel efficiently through the disc) is a good approximation of the transport of angular momentum induced by the spiral structure. Then I will describe the conditions under which the disc, rather than settling into a quasi-steady self-regulated regime, fragments into bound objects, with particular emphasis on the issue of numerical convergnece of the results. Finally I will discuss the observational prospects for detecting spiral structures in protostellar discs.