

Simulating the cradle of stars with graphics processing units

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Simulating young star clusters is a challenge for computational astrophysics. Three main aspects must be accounted for: (i) the hydro-dynamics of the parent molecular cloud, (ii) the dynamics of the newly formed stars, and (iii) the evolution of stars and binary systems.

The hydro-dynamical treatment of the gas is particularly demanding because it requires both very high resolution and a suitable cooling function. Given the high density that can be reached in the core of dense young star clusters, the stellar component requires direct-summation N-body integrators, coupled with up-to-date recipes for stellar evolution and stellar winds.

Our new group at the Observatory of Padova is involved in the most innovative simulations of molecular clouds and young star clusters. We make use of special purpose hardware, especially graphics processing units (GPUs), to meet the challenge of coupling collisional stellar dynamics and stellar evolution. In this talk, I will present our new tool for stellar evolution in direct-summation N-body codes, which is based on the new Padova stellar evolution tracks. I will also discuss some of our most recent results about star cluster formation and evolution, in the frame of our FIRB 2012 project, and of our most recent CINECA projects.

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