Title: Modelling cosmic ray acceleration in stellar clusters

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Abstract:

Cosmic rays are charged particles coming from space, whose flux is detected thanks to multiple instruments in space or on the ground. While they have been well studied since their discovery more than one century ago, the origin of their high energy components remains uncertain. In particular, although the standard explanation involving diffusive shock acceleration inside supernova remnants succeeds in describing the flux up to PeV energies, it is much less satisfactory beyond and fails to describe peculiarities of the spectrum such as the so-called knee and ankle. It seems therefore that acceleration mechanisms beyond the standard model should be considered. Among several existing hypothesis, stellar clusters and superbubbles are a promising possibility, being a natural extension to the isolated supernova model. I describe how, in such clusters, stellar winds and supernovae efficiently convert their energy into cosmic ray production. Collective effects such as colliding shock flows are studied, as well as stochastic acceleration in enhanced turbulence. I finally account for systematic reacceleration and escape through the cluster shell to build a model considering the stellar cluster as one single accelerator, aiming at deriving some expectations on the observables such as the shape of the photon spectra or their variability.