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Formation and evolution of star clusters in galactic environments

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Star clusters do not form in isolation, but enshrouded in hierarchical gaseous filaments embedded in a galactic tidal field. To understand the role of radiation, stellar winds and supernovae of massive stars in regulating the multiphase interstellar medium we must decipher how the young host clusters form, evolve and interact with their surrounding galactic environment. In this talk, I present novel hydrodynamical N-body simulations of the formation and evolution of resolved star clusters in low-metallicity dwarf galaxies where stellar dynamical interactions around massive stars are solved with an algorithmically regularized integrator. Gravitational interactions in the rest of the simulation employ gravitational softening and a tree-algorithm. The simulations include evolution tracks for radiation and element-by-element stellar winds and supernovae of individual stars, utilizing the initial stellar mass function that is realized down to 0.08 solar masses during star formation. Our simulations now capture mass segregation, dynamical binary formation and mass-loss of entire populations of star clusters as they form and evolve in a galactic environment. The clusters form initially compact, expanding rapidly after the embedded phase to match the typical effective radii of observed young star clusters (<100 Myr) in dwarf galaxies. In agreement with previous studies that used simplified treatment of runaway and walkaway stars, the reduced clustering of supernovae through the removal of massive stars from clusters has only a small impact on the galaxy-wide properties. These simulations pave the way toward detailed chemodynamical modelling of the formation of globular clusters where stellar interactions and mergers may play a significant role in the growth and feedback of very massive stars and intermediate mass black holes.

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