Formation, evolution, and survival of massive star clusters
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Environmental effects on stellar populations of star clusters and dwarf galaxies

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Abstract. We investigate the competitive role of the different dissipative phenomena acting on the onset of star formation of gravitationally bound systems in an external environment. Ram pressure, Kelvin-Helmholtz and Rayleigh-Taylor instabilities, and tidal forces are accounted for separately in an analytical framework and compared in their role in influencing the star forming regions. We present an analytical criterion to elucidate the dependence of star formation in a spherical stellar system on its surrounding environment. We consider the different signatures of these phenomena in synthetically realized colour-magnitude diagrams (CMDs) of the orbiting system thus investigating the detectability limits of these different effects for future observational projects and their relevance. The developed theoretical framework has direct applications to the cases of massive star clusters, dwarf galaxies in galaxy clusters and dwarf galaxies orbiting our Milky Way system, as well as any primordial gas-rich cluster of stars orbiting within its host galaxy.

Keywords. Star cluster, gas instabilities, star formation, colour magnitude diagrams

1. Non-inertial linear response theory for gas instabilities in spherical coordinates.

We model a time-dependent gravitationally bound system of stars and both molecular and HI gas as a spherical system interacting with the external environment (Pasetto *et al.* 2015). We derived an analytical criterion that depending on the phase space condition $\{\mathbf{x}, \mathbf{v}\}$ of the system orbiting a more massive companion allows the distinguishing of different contributions affecting the star formation $\hat{\gamma}^2(\mathbf{x}, \mathbf{v}; t) > 0$ or its absence $\hat{\gamma}^2(\mathbf{x}, \mathbf{v}; t) < 0$ on colour magnitude diagrams synthetically generated (Fig.1 upper panel). The individual component contributions, Rayleigh-Taylor type $\hat{\gamma}^2_{RT}$, mixed instability term type $\hat{\gamma}^2_{mix}$, not-inertial acceleration of Rayleigh-Taylor type $\hat{\gamma}^2_{a-RT}$, the Kelvin-Helmholtz type term $\hat{\gamma}^2_{KH}$, the inertia term type $\hat{\gamma}^2_{I}$, carry all different dependence on $\{\mathbf{x}, \mathbf{v}\}$ and are worked out analytically (See Fig.1 lower panel).

References

Pasetto S., Cropper M., Fujita Y., Chiosi C., & Grebel E. K., 2015, A&A, 573, A48
Pasetto S., Bertelli G., Grebel E. K., Chiosi C., & Fujita Y., 2012, A&A, 542, A17

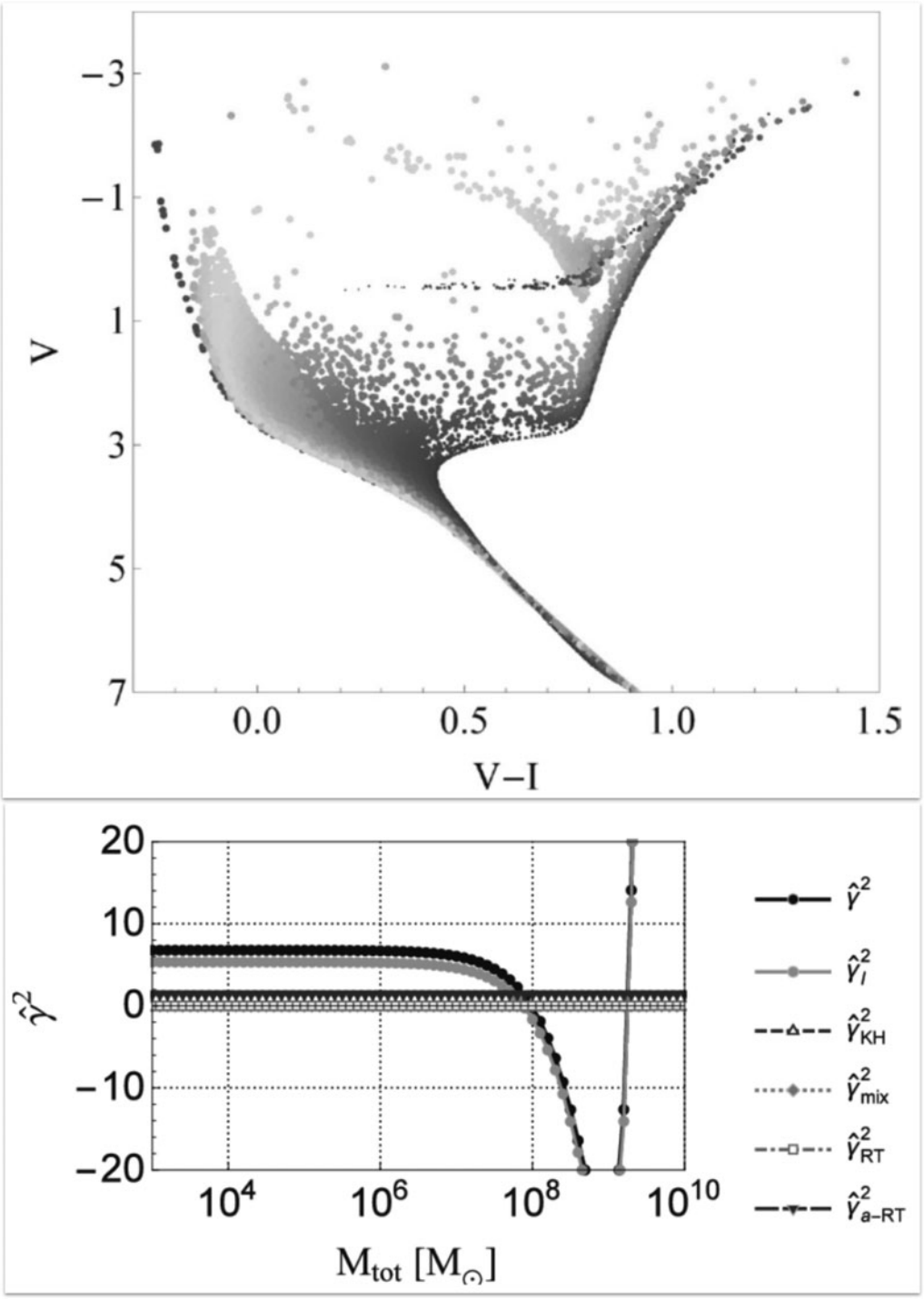

Figure 1. Upper panel: synthetic CMD realized for the simulation of the upper panel (see Pasetto *et al.* 2012 for further details). Lower panel: Instability criteria plotted as function of total mass, gas+stars, of an orbiting object for assigned location within the Milky Way external potential (see Pasetto *et al.* 2015 for further details).

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