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ORIGINAL ARTICLE

Gravitational interactions between globular and open clusters: an introduction

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Abstract Historically, it has been assumed that globular and open clusters never interact. However, recent evidence suggests that: globular clusters passing through the disk may be able to perturb giant molecular clouds (GMCs) triggering formation of open clusters and some old open clusters may be linked to accreted globulars. Here, we further explore the existence of possible dynamical connections between globular and open clusters, and realize that the most obvious link must be in the form of gravitational interactions. If open clusters are born out of GMCs, they have to move in similar orbits. If we accept that globulars can interact with GMCs, triggering star formation, it follows that globular and open clusters must also interact. Consistently, theoretical arguments as well as observational evidence, show that globular and open clusters certainly are interacting populations and their interactions are far more common than usually thought, especially for objects part of the bulge/disk. Monte Carlo calculations confirm that conclusion. Globular clusters seem capable of not only inducing formation of open clusters but, more often, their demise. Relatively frequent high speed cluster encounters or cluster harassment may also cause, on the long-term, slow erosion and tidal truncation on the globulars involved. The disputed object FSR 1767 (2MASS-GC04) may be, statistically speaking, the best example of an ongoing interaction.

Keywords Open clusters and associations · Globular clusters · Globular clusters: individual: FSR 1767 · Stars: formation · Galaxy: disk

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1 Introduction

It is becoming increasingly clear that the observed field stars are mostly the by-product of the disruption of some type of stellar ensemble (see e.g. Hopkins 2013), bound (star cluster) or unbound (stellar association). The vast majority of clusters or stellar aggregates are not long-term stable and dissociate into individual stars shortly after their formation (e.g. Tutukov 1978; de la Fuente Marcos and de la Fuente Marcos 2004; de Grijs 2009; Goodwin 2009); moreover, the majority of stars appear to form in low density environments—associations—not dense star clusters (e.g. Fritze 2009; Bressert et al. 2010; Gieles and Portegies Zwart 2011). The fraction of all stars in the Universe once formed in bound star clusters is currently estimated at 30–35 % (Kruijssen 2012). These facts explain why, at any epoch, most stars in a galaxy are not associated to clusters but to the overall field. Within galaxies, a range of external forces can trigger giant molecular cloud (GMC) fragmentation which in turn, leads to stellar association and star cluster formation within star-forming complexes (see e.g. Elmegreen and Lada 1977; Efremov 1978, 1979; Elmegreen and Efremov 1996; Efremov and Elmegreen 1998). In this context, star clusters and associations appear as primary galactic building blocks.

Historically, star clusters in the Milky Way are split up into two distinct, fully independent, seemingly unrelated populations: globular and open clusters. In general terms, this traditional view appears to be well supported by available observational data: globular and open clusters show significantly different structural and kinematic properties and the two groups seem to be of rather different origin (see e.g. Sparke and Gallagher 2007). Consistently, it has been customarily assumed that globular and open clusters never interact; i.e., there are no connections between the two types