THE DEPLETION OF GIANTS IN GLOBULAR CLUSTERS

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Abstract. A significant depletion of red giants is observed in the central regions of post-collapsed globulars (Djorgovski *et al.*, 1993) like M 15 (Stetson, 1991). A simple model shows that the depletion of red giants in the high-density cores of globular clusters can be understood in terms of mutual stellar collisions. Slightly outside the core stellar collisions are not frequent enough to explain the reduction in the observed number of red giants.

1. The model

The stellar system is represented by a computational box (with a density of $10^6 \star/\mathrm{pc}^3$ and size 0.1 pc) which is static, homogeneous and in thermal equilibrium. Each of the 40000 star in the simulation is given a mass from the initial mass-function and a velocity according to equipartition. Since only the core of a collapsed cluster is modeled i use a fit to the mass function derived from observations from the core of 47 Tuc. (see Meylan, 1989). In the model the radius of a star is a function of its mass and age using parameterized evolutionary-tracks (Eggleton *et al.*, 1989 and Portegies Zwart and Verbunt, 1996). The size, mass and velocity of the stars are used to determine the collisions rate in the modeled cluster-core (for details see Portegies Zwart *et al.*, 1996). A Monte-Carlo technic is used to decide when and which two stars merge conservatively as a result of a collision. Since it is unrealistic to let the stars be born in a high-density cluster, i switch on the dynamics at $T = 8$ Gyr and stop the simulation at $T = 16$ Gyr.

2. Results

Due to their large geometric- and gravitational-focusing cross-section the encounter probability for a giant is considerably larger than for a main-

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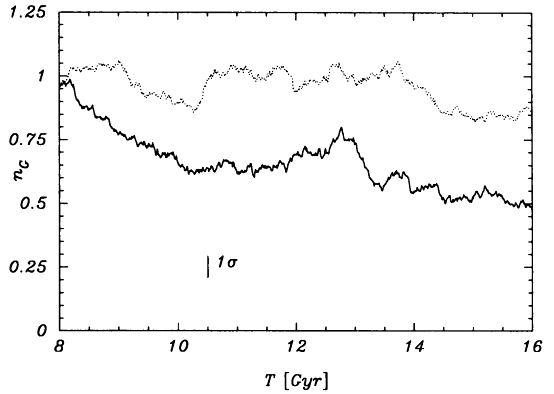

Figure 1. The total number of giants from two model computations are presented as fraction of the total number of giants expected from a computation where no collisions took place. The lower line is from the high-density model, the upper line is from a model with a core radius of 0.5 pc and a density of $2 \cdot 10^5 \star/\mathrm{pc}^3$. As a consequence of the small number of giants in the simulations, the error is large (see one-σ Poissonian error-bar).

sequence star. However, their small number and short lifetime puts strong limits on the total number of giants that experience an encounter. A collision between a giant and another star generally reduces the lifetime of the collision product and results is a depletion of giants in the high-density cluster-core (see Fig. 2 lower line) where a lower density cluster does not show a significant depletion of giants (upper line). Only in a stellar system with an extremely high stellar-density the depletion of giants can have a collisional origin. Outside the core of a high-density globular, collisions between stars are not frequent enough to explain the depletion of giants.

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