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Investigating the effect of massive stars on the dynamical evolution of open clusters, using optimal and random sampling

M Rabiee, A Hasani Zonoozi, and H Haghi

Department of Physics, Institute for Advanced Studies in Basic Sciences, Zanjan, Iran

E-mail: m.rabiee@iasbs.ac.ir

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Abstract
Massive OB stars have an important effect on the dynamical evolution of open star clusters. In the simulation of star clusters, the sampling method to determine the mass function of the cluster affects the number and mass of massive stars. Two methods of "optimal sampling" and "random sampling" have been proposed to initialize the cluster stars. In the random sampling method, the mass of the heaviest star and the number of massive stars change randomly, which affects the dynamical evolution of young open clusters. Our investigations show that, if nature follows a random sampling method in star formation, the evolutionary path of low-mass clusters with the same initial conditions can be completely different, depending on the number of OB stars. Therefore, in models with more OB stars and thus more stellar remnants, they lose at a faster rate and dissolve in a shorter time. It is also shown in this paper that the retention of stellar remnants in the cluster plays an important role in the evolution of the cluster. In models with more massive stars, the dissolution rate increases if stellar remnants are retained in the cluster. However, considering the realistic models for these young and low-mass clusters in which most of the stellar remnants leave the cluster immediately after formation, the difference between the evolutionary tracks of the models with OB-min and OB-max stars decreases.

Keywords: open cluster, initial mass function, optimal sampling, random sampling

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