

R33a Formation of intermediate mass black holes in low central-density clusters with mass segregation

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We investigated the role of initial mass segregation within dense star clusters for the formation of intermediate mass black holes (IMBHs) through runaway merging. We followed the evolutions of multiple-mass dense star clusters with up to 131072 stars by direct N-body simulations for a duration of 3 Myrs. A wide variety of initial cluster models was considered, including different description for mass segregation and different initial concentration.

Initial mass segregation was realized by varying the minimum mass within a certain lagrangian radius of the initial mass function, as well as by changing the lagrangian radius within which the initial mass segregation takes place. In this present study, we examined cluster models with central potential of $W_0 = 3.0, 5.0, 7.0$, and 9.0.

We found that, without mass segregation, runaway merging could not happen in MGG-11 type clusters with central potential less than $W_0 = 9$, in agreement with the findings of Portegies Zwart et al (2004). Taking into account the effect of mass segregation, we found that clusters with central potential $W_0 = 7$ or less indeed show runaway merging and produce IMBHs up to $\approx 3300 M_\odot$.