THE ROLE OF HARD BINARIES IN CLUSTER EVOLUTION

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ABSTRACT. The presence of an initial binary population in a stellar cluster can have a dominant effect on the dynamical evolution of the whole system. We discuss simulations, carried out with a direct N-body method for several models with N = 300 equal mass objects, with 20% of all the stars as initial binaries having different binding energy. These calculations show that binaries with values of the binding energy, h, in the range 5 - 10 times the mean kinetic energy, x, are the most strongly interacting ones with the field stars and between themselves. The main result of these interactions is an enhanced expansion of the core and also of the whole cluster. The binary heating prevents the gravitational collapse for a time longer than the collapse time for systems without binaries. Energetic binaries with h greater than 25x concentrate at the center, due to mass segregation but these binary-binary interactions produce disruption and escape of the components, with smaller heating effect. Binary-binary interactions occur predominantly in the inner regions and are mainly responsible for the core heating and for the escaping stars. Single star-binary encounters, instead, occur more frequently in the outer regions, and only contribute to the strong expansion of the halo. In all the simulations there was no formation of new persistent hard binaries.

Further details of these calculations will be published elsewhere.

J. Goodman and P. Hut (eds.), Dynamics of Star Clusters, 321.