

## PREFACE

This symposium was first proposed in August 1993 when some members of my international collaboration on gravitational  $N$ -body problems gathered in Tokyo. The timing of the proposed Symposium was set as 1995 considering that a Tera-flops computer dedicated to  $N$ -body problems would become operational. At the same time the Symposium was intended to be situated in the third of a series of similar IAU Symposia.

The first one was IAU Symposium No.69 on Dynamics of Stellar Systems that was held in Besançon in 1974. Therein, the gravothermal collapse of globular cluster cores became one of the interesting topics for further elaboration. Before the second one, Symposium No. 113 on Dynamics of Star Clusters held in Princeton in 1984, the gravothermal collapse of the cores of globular clusters was worked out. Some globular clusters were observationally found to have collapsed cores and models of the gravothermal collapse were theoretically developed including similarity solutions of the collapse. So the problem of so-called post collapse evolution was selected as one of the main topics in the second Symposium. It became also one of the main subjects for theoretical investigations for the following decade, into the 1990's.

During this decade high resolution observations have made great progress with the help of CCD cameras and Hubble Space Telescope. Thus, we are now able to investigate densely populated regions of star clusters and galaxies as well as to classify every type of star. On the other hand, the progress in numerical modeling of the stellar systems should be noted. Now, it is the time to integrate such observational data into models where stellar evolution is combined with stellar dynamics including the evolution past core collapse. It will be one of the main aims of the present Symposium to open a new phase in the study of the evolution of stellar systems.

In this context it will be interesting to recall what was discussed in the preceding Symposium, No. 113, at the session of the Panel Discussion entitled *What Next? Priorities in Theory and Observations*. The panelists pointed out the following. Lyman Spitzer stressed the importance of investigating the effects of finite size of the stars, and the origin and history of actual globular clusters. Alar Toomre was interested in studying further how globular clusters came into being and how they end up. Tjeerd Van Albada pointed out the possible importance of the absence of high density globular clusters in the outer regions of the Galaxy and of the interaction between dynamical evolution and stellar evolution. Scott Tremaine discussed the evolution of the outer parts of clusters as a result of evaporation

of the stars and of tidal interaction with the external gravitational field. Simon White recommended further study of the influence of the external field, and of the origin of globular clusters. Ivan King discussed the importance of studying the effect of mass mixtures in globular clusters and mass segregation due to their dynamical evolution. At the same time he pointed out, quite correctly, the importance of the expected progress in ground based CCD observations as well as Space Telescope observations.

In these four days of the present Symposium, we will see how such subjects have made progress. In my feeling, the progress in observations has been enormous while that in theoretical modeling seems somewhat left behind. One of the reasons has been that the problems are too compute-intensive for the existing supercomputers. For instance, modeling the post-collapse gravothermal oscillations in a direct  $N$ -body simulation remained inconclusive in simulations including several thousand bodies, because of the large statistical fluctuations present. Now, we can, however, have supercomputers with great amounts of memory to perform 3-dimensional hydrodynamic calculations of stellar collisions, and we have a dedicated computer which is several tens of times faster than general-purpose supercomputers. Therefore, I expect that the present Symposium will provide us with the future prospect of how observational and computational astronomy can be combined to clarify the evolution of realistic stellar systems.

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Daiichiro Sugimoto, Chair, Scientific Organizing Committee



These proceedings are dedicated to the memory of Prof. Subramanyan Chandrasekhar, in recognition of his fundamental research on the dynamics of star clusters, and his many other profound contributions to astrophysics.