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Binary star clusters in galaxies : Our galaxy

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1. Introduction

Evidence of star clusters in complexes or groups indicates the possible existence of binary star clusters. Binary clusters are being increasingly observed in the Large Magellanic Cloud, but in our Galaxy, their existence remains tentative, except for the double cluster h+x Persei (see Subramaniam et al, 1995). We study the dynamics of the binary star clusters in galaxies, under the disruptive influence of the galactic tidal field through N-body simulations. Here, we study the dynamics in our Galaxy.

2. Computation

The N-body simulations were done using a modified version of the TREECODE (Hernquist 1990)

- Galactic tidal force :
  The Galactic potential has been taken from Carlberg & Innanen 1987, which is determined from the observed rotation curve.

- Initial Conditions :
  Masses of both clusters are taken to be identical. They are assigned Galactocentric positions and the appropriate velocities.

Cluster masses	1000–5000$M_\odot$
Cluster radii	2–10 pc
Internal velocities	Virial
Number of stars	1000-2000

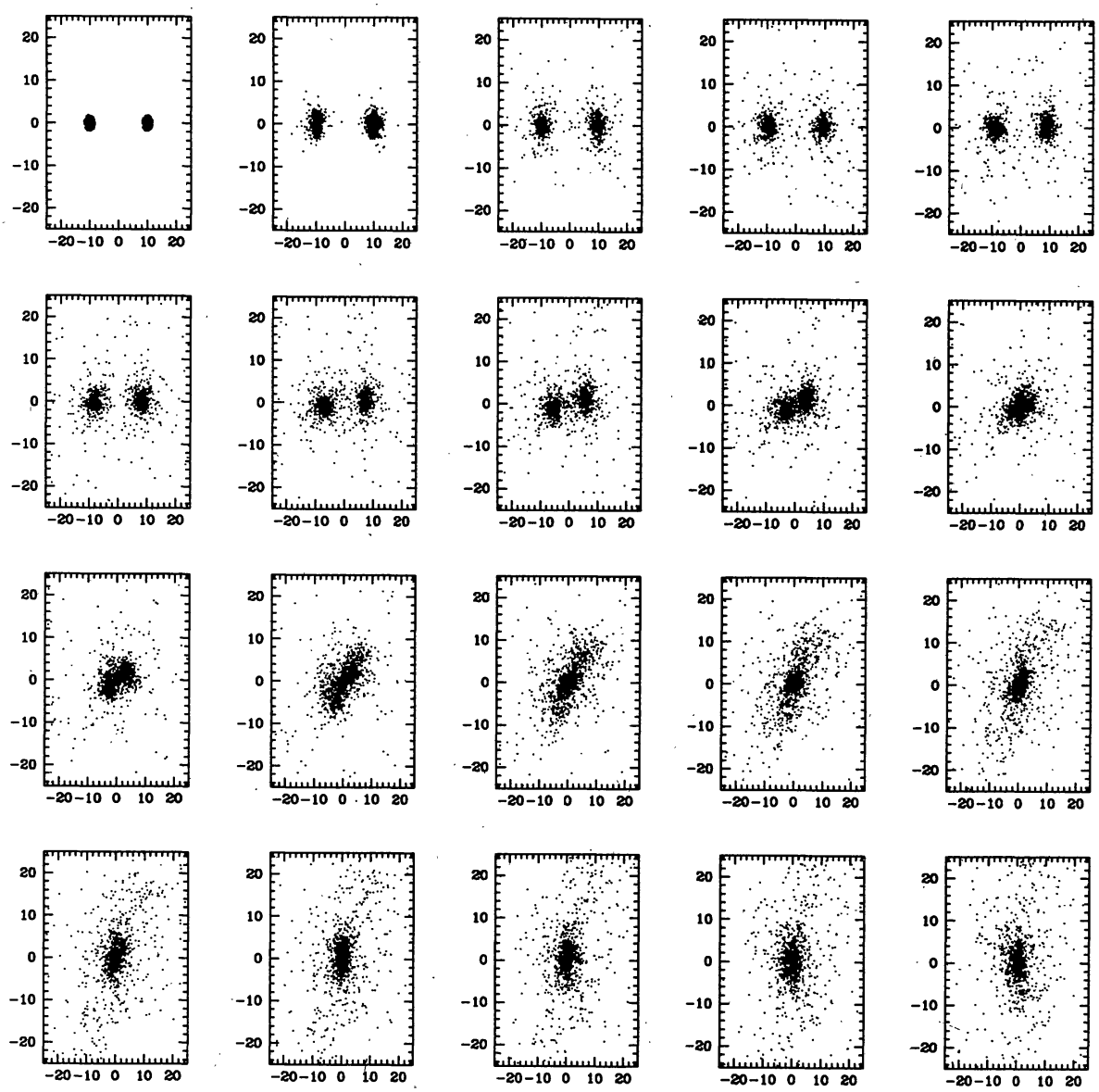

Figure 1. A typical merging cluster pair is shown here. The initial separation is 20pc at 10 Kpc from the Galactic center, parallel to the plane. The snapshots are taken at an interval of 5 Myr.

Table 1. The results of n-body simulations are presented here

Model	Cluster mass	Cluster Radius	Separation	R_G	τ_M
	$M_\odot$	pc	pc	Kpc	Myr
A	1000	2	16(⊥)	7	90
B	1000	2	19(∥)	7	100
C	1000	2	20(⊥)	10	150
D	1000	2	23(∥)	10	100
E	1000	2	22(⊥)	13	160
F	1000	2	27(∥)	13	140

Results

We present the preliminary results of dynamics of binary open clusters in the disk of our Galaxy. We investigate the dynamical evolution of two open star clusters born nearby, under the influence of the tidal field of the Galaxy, using n-body simulations. Within the range of parameters considered, the upper limits of separation for mergers was found to be 16-30 pc. The merger time increases for separations oriented perpendicular to the galactocentric radius vector. Merger is faster for more massive clusters. Clusters with long merger times (~10^8yr) spiral in slowly and remain as binary clusters for time scale comparable to their individual lifetimes. The mergers very often result in the formation of a rich dense cluster which can survive the disruptive influence of the galactic tidal field for longer periods of time.

References

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