A Special-purpose Computer for Gravitational Many-body Problems and Merger Simulations

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A backend processor has been constracted which is a pipeline for calculating the gravitational force exerted on one particle from the rest in an astrophysical many-body system (Sugimoto et al. '90). The first version of the processor, GRAPE-1 (**GRA**vity Pip**E**), was designed with 8 bits floating point format for use in collision-free systems (Ito et al. '90). It is in operation at the speed of 120M flops equivalent.

Numerical simulations of five mergers have been made with GRAPE-1 (Table 1). The results shows that the merger remnants with small pericentric distance (r_p, see Table 1) have low rotation velocities. They are supported by anisotropic pressure. Their shape and kinematic properties are consistent with those of bright elliptical galaxies (Figure 1). We also derived the phase space density (Carlberg '86) in the mergers and they merginally conserve. But f_c in the real merger should decrease from those of an initial galaxy. The mergers show a little large velocity dispersion compared with that in the initial galaxy. The Faber - Jackson relation is merginally satisfied in the process of merging. These results suggest that most bright ellipticals with slow rotation might be the results of mergers of faint ones.

Table 1(initial = Plummer model)

Number	1	2	3	4	5
r_p	0.0	0.5	1.0	2.0	3.0
e	1.0	1.0	1.0	1.0	0.8

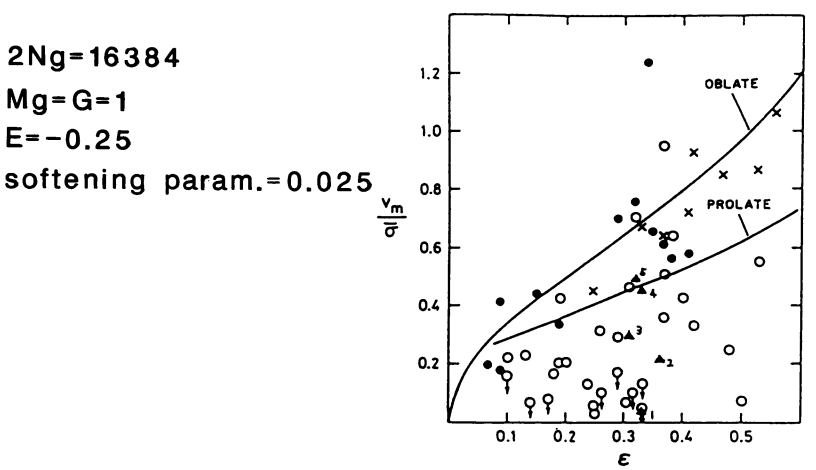

Figure 1 Peak rotation velocities devided by velocity dispersion are plotted against ellipticity of galaxies. Open and filled circles are luminous (MB < -20.5) and faint ellipticals, respectively. Crosses are the bulges of spirals (Davis 1987). The results of this work are represented by triangles. Numbers are the same as in Table 1.

F. Combes and F. Casoli (eds.), Dynamics of Galaxies and Their Molecular Cloud Distributions, 356.