SIMULATIONS OF COMPACT GROUPS OF GALAXIES WITH HALOS

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Self-consistent simulations of seven groups are performed from the maximum expansion to the present using Aarseth's N-body code. An initial galaxy consists of 100 stars. Its mass, half-mass radius, and central velocity dispersion are 1, 0.41, and 0.96. Units of mass, length, velocity, and time are $1.4\times10^{12}M_\odot$, 100 kpc, 245 kms^{-1} and 4.0×10^{8}y. Table 1 gives the elapsed time from the Big Bang to the formation of a multiple merger tm+Tc*/2. For $H_0=80$ $kms^{-1}Mpc^{-1}$, the Hubble time $H_0^{-1}=30.6$ in our units. Dense groups except B form multiple mergers in a Hubble time.

Table 1. Initial Parameters of Simulated Groups

Model	No. of galaxies	radius	velocity dispersion	β*	$-E_0$*	tm+Tc*/2	cD now expected?
A shell	10	10	0.12	0.01	6.21	18.6	Yes
B sphere	10	20	0.	0.	2.99	61.6	No
C disk	10	10	0.10	0.006	8.35	13.8	Yes
D sphere	10	10	0.10	0.009	5.88	22.5	Yes
E sphere	10	10	0.18	0.03	5.09	31.2	Yes
F sphere	10	10	0.58	0.34	4.99	31.6	Yes
I sphere	50	20	1.52	0.80	71.86	30.0	Yes

E_0*=the initial total energy of a group when galaxies are point masses, β*=the initial ratio of the random kinetic energy to $-E_0$* when galaxies are point masses, $Tc^*=2\pi(3/5)^{3/2}GM^{5/2}/(-2E_0^*)^{3/2}$, tm=the epoch of merger formation when at least four galaxy cores are merging.

Figure 1 shows the virial diagram for Geller-Huchra's(1983) groups. The loci of A, E, F and I are obtained using the projected positions and line-of-sight velocities of surviving cores in the merging phases. They fall along a line of constant density $3Tc^*/2=H_0^{-1}$. Thus, almost compact groups with $3Tc^*/2<H_0^{-1}$ are expected to have cD galaxies now. However the frequency of cD galaxies in Geller-Huchra groups is 7% in the range $3Tc^*/2<H_0^{-1}$ and $M<10^{14}M_\odot$. The scarcity of cD's requires us to reduce such a high merging rate by decreasing the size of halos.

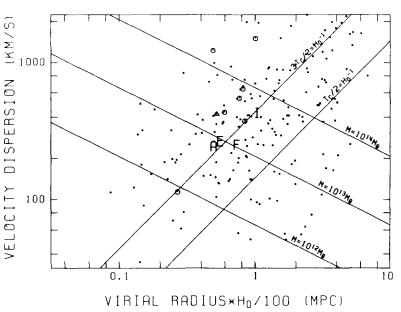

Figure 1

Thus, if galaxies in a group have been formed with not a large velocity dispersion by the phase of maximum expansion and if $H_0<80$ $kms^{-1}Mpc^{-1}$, the half-mass radii of the halos should be less than 41 kpc.

REFERENCE

Geller, M. J. and Huchra, J.P.: 1983, Astrophys. J. Suppl. **52**,61.

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