MASS DISTRIBUTIONS OF GALAXIES WITH GLOBULAR CLUSTER SYSTEMS

Kazutomo Takayanagi

Ryukoku University and Kyoto University

Density curves of polytrope index 5 were fitted to the surface density distributions of 26 globular cluster systems. Though we have shown only two of them in Fig. 1, the remaining systems resemble the above cases. No differences exist between elliptical and spiral galaxies.

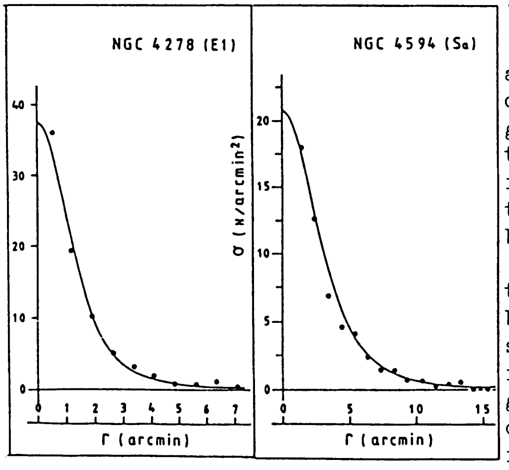

Fig. 1. Surface density distributions of globular cluster systems with the best fit of the polytropes (solid lines).

If we can regard the globulars associated with a galaxy as tracers of mass distribution of the parent galaxy, this can be represented by that of the globular cluster system in spite of some discrepancy between the mass and the brightness distributions.

Assuming that the density distributions of the galaxies with globular cluster systems can be represented by those of the polytrope of index 5, we obtained masses of the galaxies by putting central velocity dispersions of these galaxies in the following formula;

$$m = \sqrt{3}\,\alpha^3 \rho_c = (2\sqrt{3}\,\alpha\,\overline{V_p^2})/G$$

where α is a scale factor which is obtained in the process of the fit mentioned above.

The results have been shown in Table 1. Masses of twelve ellipticals and one spiral (Sa) are order of $10^{12}\,m_\odot$. M87 is the most massive galaxy even in this study.

The masses obtained above and the various physical parameters which have been taken from catalogs and lists in other papers have been combined to examine the correlations among them though only two of

J. E. Grindlay and A. G. Davis Philip (eds.),
The Harlow-Shapley Symposium on Globular Cluster Systems in Galaxies, 639–640.

them have been shown in Fig. 2, all the correlations obtained and their least square solutions are as follows;

Table 1

Masses of the galaxies with the globular cluster systems.

GALAXY (NGC) (1)	α (2)	$\overline{V_r^2}$ (Km/s) (3)	d (Mpc) (4)	MASS ($10^{10} M_\odot$) (5)
224	3.333	166	0.66	22
524	1.186	270	43	260
1052	0.800	204	24	56
1399	0.841	*250	22	81
2683	1.360	142	22	15
3226	0.597	207	20	36
3311	1.565	*250	55	380
3377	0.976	160	10	18
3379	0.800	218	13	35
3607	0.733	240	14	42
4278	1.155	243	14	68
4374	2.121	296	20	260
4406	3.259	256	20	300
4472	2.213	315	20	310
4486	3.983	335	20	610
4526	2.757	275	20	290
4565	1.302	136	20	34
4594	2.706	256	20	250
4621	2.684	225	20	190
4636	2.673	217	20	180
4649/	3.596	344	20	600
4697	1.788	186	20	87
5128	4.904	*100	5.0	17
5813	0.949	281	31	110
5846	1.163	250	29	150
Galaxy	3.142	*137	//	14

(1) $\log N_t = 0.91 \log m - 7.9$

(2) $\log m = 0.89 \log D_g^3 + 8.3$

(3) $\log m = -0.51\, M_B + 1.2$

(4) $\log N_t = -0.37\, M_B - 4.9$

(5) $\log N_t = 0.014\, R_G + 2.4$

(6) $R_G = 2.3\, D_g - 12$

(7) $\log N_t = 0.70 \log D_g^3 + 0.082$

(8) $m/L_B = 0.10 + 14$

(9) $M_B = -1.8 \log D_g^3 + 14$

where D_g means a geometrical mean of the major and the minor axis of the parent galaxy and R_G is the radius of the cluster system derived from the density curve.

We showed that the mass distributions of galaxies fit well the distributions of polytrope index 5. This fact suggests that the mass distributions of galaxies (halos) have been formed in the gas stage because the form of the polytropic density distribution is thought to be the result of collisions of the elementary particles of which it made.

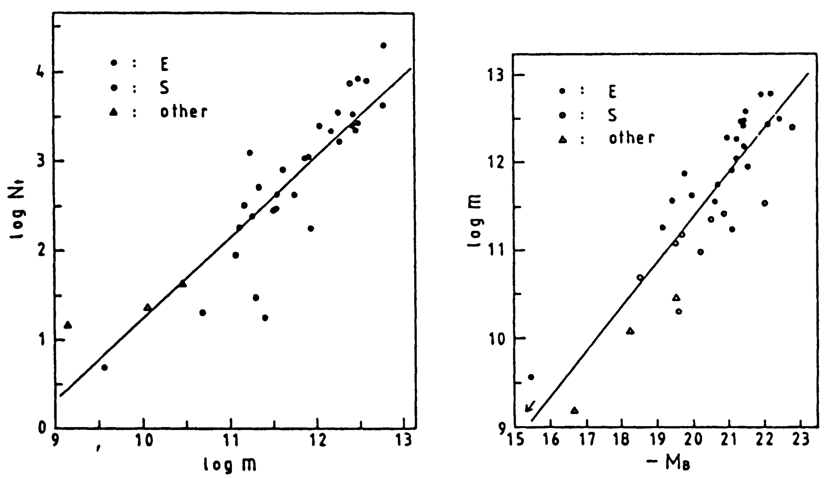

Fig. 2. Correlations of physical parameters included in our work.

https://doi.org/10.1017/S0074180900043436 Published online by Cambridge University Press