SPATIAL DISTRIBUTION OF GLOBULAR CLUSTERS IN M 31

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ABSTRACT: The spatial distribution of globular clusters in M 31 has been analyzed using the catalogues of Sargent et al. (1977) and Crampton et al. (1985). It is concluded that the globular clusters within the distance of 54′ from the center of M 31 show an elliptical distribution aligned to the major axis of the disk. This is similar to the distribution of metal-rich clusters in our galaxy.

We re-examine whether the concentration of globular clusters on the major axis reflects incompleteness of the surveyed region or intrinsic distribution, using moment analysis up to the second order. We sample a region within 54′ from the center which is the largest possible circle in the surveyed region of Sargent et al. (1977), and within 35′ in that of Crampton et al. (1985). We regard the galactic nucleus as the center of the distribution. From the moments of the second order, we can reconstruct an ellipse of the distribution of globular clusters. If globular clusters concentrate onto the disk, the position angle of the major axis of this ellipse is close to that of the disk. Our calculations with four different radii of the circle are shown in Table I.

Globular clusters behind the nucleus may be hidden. This obscuration is limited within 15′ (de Vaucouleurs and Buta, 1979). We calculated the second order moments without the clusters whose distances are less than 15′ from the nucleus. These results are shown in Table II. These results suggest that the globular clusters within 54′ from the center concentrate loosely onto the major axis of the disk.

In our Galaxy, globular clusters with high metallicity concentrate on the galactic nucleus (Harris 1976). Zinn (1985) also noted that a flattening of the spatial distribution of metal-rich clusters exists. If there is a metallicity gradient of the globular cluster system of M 31, then globular clusters of the inner region that we calculated, may be metal rich; since the globular cluster system in M 31 has the same characteristics as those in our Galaxy.

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Table I.

Results of the calculation of the second order moments.

Radius	P.A.	Diff.	Axial ratio	N
	Data from Sargent et al. 1977.			
25'	45.0	+7.3	0.73	154
35	39.1	+1.4	0.83	197
45	37.7	0.0	0.81	237
55	35.3	-2.4	0.76	273
	Data from Crampton et al. 1985			
25	41.4	+3.7	0.73	197
35	35.5	-2.2	0.79	258
[45	36.9	-0.8	0.74	312]
[55	32.4	-5.3	0.68	370]

Table II.

Results without the central region.

Radius	P.A.	Diff.	Axial ratio	N
	Data from Sargent et al. 1977.			
15-25'	46.0	+8.3	0.68	77
15-35	39.7	+2.0	0.83	120
15-45	38.0	+0.3	0.81	160
15-55	35.4	-2.3	0.76	196
	Data from Crampton et al. 1985.			
Radius	P.A.	Diff.	Axial ratio	N
15-25'	41.9	+4.2	0.68	92
15-35	35.7	-2.0	0.78	153
[15-45	36.9	-0.8	0.73	207]
[15-55	32.4	-5.3	0.67	265]

Disk 37.7 (de Vaucouleurs 1958)

Col. 1. Radius of the circle used for the calculations.
Col. 2. Position angle of the major axis of the fitted ellipse from the second order moments.
Col. 3. Displacement of the position angle of the major axis of the fitted ellipse from that of the disk.
Col. 4). Ratio of the major to the minor axis of the ellipse.
Col. 5. Number of globular clusters used for the calculations.

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