SEARCH FOR GLOBULAR CLUSTERS IN NEARBY GALAXIES II. NGC 3109

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ABSTRACT: We report on the search for globular clusters around NGC 3109, a SB(s)m nearby galaxy using observations taken with the wide field telescope at La Silla. Clusters are discriminated by using the advanced image processing software (MOAN). From 320 objects, 23 candidates are retained. Their luminosity function peaks at m_v = 19.8, thus giving the distance of the parent galaxy as 2.13 Mpc. The radial distribution follows the $D_p^{1/4}$ law well. The total number of clusters is estimated at 40 ± 25 and the specific frequency S_v = 3 clusters per M_v = -15.

1. OBSERVATIONS

The observations were done at La Silla in January, 1985, using the Mc Mullan electronographic camera (Mc Mullen and Powell 1976) attached to the f/8.6 focus of the Danish 1.54 Richey-Chrétien reflector. The usable field of the camera is 83 mm in diameter (scale 19"/mm) giving a total field of 26.2'.

2. DATA PROCESSING AND GEOMETRICAL ANALYSIS

All suspected non-stellar objects were numbered together with a regular net of well exposed stars. Objects were scanned with a 10 micron aperture on the Geneva Microdensitometer System (Blecha 1982). Scanned areas were centered on the object of interest, with 30 x 30 points spaced by 10 microns in both x and y directions (6 x 6").

Each field was processed in order to extract the geometrical parameters of the image. The MOAN software package (Blecha 1982, 1984) uses 3 shape parameters to describe the local true two-dimensional PFS, called a Gaussian Modified Profile (GMP). Two other parameters, C and D, are fixed for each plate in order to account for various seeing conditions and/or telescope adjustments. The parameters extracted are: x_o, y_o, the position of the centroid; e,f,w, shape parameters (ellipticity, orientation and width) and B_g, the local background.

The "net" of selected stars is used to "map" the PSF over the

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whole plate. The mapping is done by fitting a 3rd degree 2-D polynomial on the set of shape parameters extracted from 55 stars. As the variation of the PSF shape is slow, the mapped profiles match the image data for the stars almost perfectly. The method used here is that described by Blecha (1984, 1986).

The selection of clusters is based on the following criteria: Geometrical Aspects (object width > 0.5", residual ellipticity < 1.45, smooth objects, abnormally high RMS rejected) and Photometric Aspects; (only objects with 0 < (B-V) < 1.6)

3. GLOBULAR CLUSTER SYSTEM

From initially 320 objects, 23 remain in the list after the selection. We included four very large objects (FWHM > 2") because one of them has (B-V) = 0.8; such a globular cluster will be two to three times larger than the largest cluster in our galaxy (Blecha 1986). The luminosity function, though incomplete, peaks approximately at m_v = 19.8. Assuming A_v = 0.30 and the peak M_v = -7.2, we obtain the true distance modulus $(m_v - M_v)_o$ = 26.70, giving a distance of 2.18 (+0.5, -0.2) Mpc. Our distance is in good agreement with the H II region dimensions, but in strong contradiction with the distance of 1.17 Mpc given by Elias and Frogel (1985) based on infrared photometry of a few bright stars.

4. CLUSTER DISTRIBUTION AND THE TOTAL POPULATION

If a distance of 2.2 Mpc.is assumed, the $r^{1/4}$ law fits well with the data;

$$\mathrm{Log}(N) = 0.6 \pm 1.86\ F_p^{1/4}.$$

By integrating the radial distribution and accounting for the missing part of the luminosity function we obtain a total population of 45 ± 25 globular clusters. Assuming the true distance modulus $(m_v - M_v)_{app}$ = 26.70, total apparent B magnitude BM_T = 10.27 (Carignan 1985), $(B-V)_T$ = 0.52 and A_B = 0.41, the specific frequency per M_v = -15 used by van den Bergh (1984) is 3.08.

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