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APERTURE PHOTOMETRY OF FAINT GALAXIES. VOID 1312+35[1]

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1. Introduction. This paper is a part of a collaborate project between the Department of Astronomy, Bulgarian Academy of Sciences and Max-Plank-Institute of Astronomy, Heidelberg, Germany. The project is devoted to the investigating of large spaces that lack galaxies called voids. For details and more information about voids refer to [1-4].

The results already published [5-7] show that in previously studied voids a large amount of faint galaxies are really observed. However, whether a certain void does exist or not, a distance to the extragalactic objects detected in it must be known, but the receiving of spectra for such faint galaxies is a problematic task.

In this paper we present a ring aperture B-band photometry for 82 more interesting and bright galaxies detected in void 1312 + 35(1950). Using this data we discuss the distribution of distance galaxies in space according to visible magnitude and diameters. Finally we draw a conclusion that in these data there are no evidences that confirm the existing of a large space empty of galaxies, e.g. a void in direction 1312 + 35.

444 galaxies were detected altogether in this void and their coordinates are available agAComputer catalogue on DECstation. In section 2 the observations and reductions al^Bescribed. In section 3 are presented the main results . Section 4 is a discussion. The conclusions are in section 5.

2. Observations and reductions. Plate N 1890 with coordinates alpha 13 h 12 m —delta + 35 deg (1950) was taken by us during the night of 27/28 April 1992. We used the Ritchie camera of the 2-m Ritchie-Cretien Coude telescope, at the National Astronomical Observatory, Rozhen, Bulgaria. ORWO plate ZU 21 with dimensions 30 X 30 cm was used. In the telescope this plate covers a field of one square degree approximately. The exposition time was 150 minutes, enough to detect faint objects. The seeing was very good, *1"* or even better.

Coordinates of the 444 galaxies, all that were detected on the plate, were measured on an ASCORECORD machine in Sofia. SAO standard stars taken with OVERLAY programme on VAX machine in Heidelberg, Germany were used as astrometric standards. A software for PC made by one of us (A.S. —Astronomical Utilities Programme) was used to convert the rectangular coordinates of the measured objects to equatorial ones for the equinox 1950.

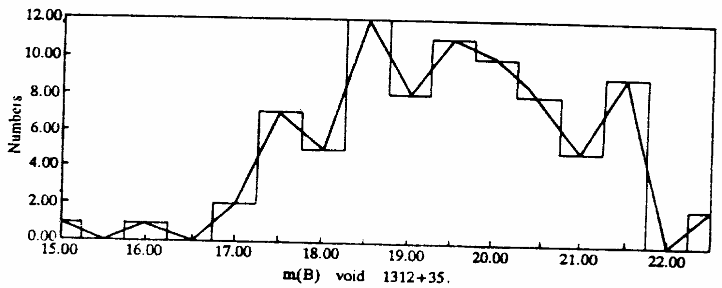

Fig. 1.

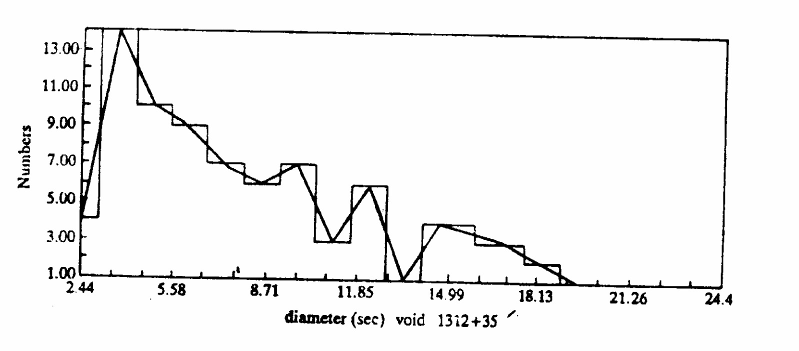

Fig. 2.

Table 1

alpha(1950)	Delta(1950)	mB	apert(sec)	alpha(1950)	Delta(1950)	mB	apert(sec)
1	2	3	4	1	2	3	4
13 09 28.8	34 51 48	17.64	19.52	13 11 13.1	35 17 11	20.12	6.10
13 09 30.7	34 53 52	18.03	8.54	13 11 13.8	35 01 46	19.64	4.88
13 09 33.0	34 47 30	19.53	6.10	13 11 21.5	34 40 03	19.48	7.32
13 09 37.4	35 02 53	19.72	7.32	13 11 35.4	34 42 42	19.43	9.76
13 09 50.7	35 16 54	19.36	7.32	13 11 44.5	34 57 43	17.60	9.76
13 09 51.1	34 56 36	20.65	3.66	13 11 49.3	34 37 06	19.22	4.88
13 09 51.8	34 57 13	19.96	3.66	13 11 49.4	34 37 01	19.06	6.10
13 09 52.9	34 56 14	18.03	8.54	13 11 52.0	34 39 51	19.43	7.32
13 09 55.4	34 56 37	19.86	4.88	13 11 52.6	34 39 47	20.31	4.88
13 09 57.3	35 16 34	17.24	17.08	13 11 55.2	35 23 11	18.72	12.20
13 09 58.3	35 23 14	21.32	2.44	13 11 56.8	34 46 20	17.80	10.98
13 09 59.4	34 49 43	18.98	7.32	13 12 10.6	35 01 47	19.57	6.10
13 09 59.7	35 23 27	18.45	18.30	13 12 19.9	35 18 02	20.33	14.64
13 10 03.6	34 39 17	16.70	12.20	13 12 20.8	35 18 03	17.42	3.66
13 10 05.3	35 21 51	20.30	4.88	13 12 25.7	35 24 46	16.68	9.76
13 10 06.4	35 03 28	18.42	12.20	13 12 29.2	34 48 05	18.07	21.96
13 10 08.2	35 20 34	20.07	6.10	13 12 29.3	35 10 11	18.90	9.76
13 10 08.8	34 36 17	17.45	13.42	13 12 29.7	35 10 14	19.42	9.76
13 10 14.5	35 22 45	18.07	14.64	13 12 32.5	35 19 00	19.14	7.32
13 10 15.0	34 52 07	18.58	18.30	13 12 34.6	34 58 04	16.59	17.08
13 10 27.9	35 04 14	17.38	24.40	13 12 47.1	34 43 28	18.43	8.54
13 10 31.1	35 21 02	18.34	9.76	13 12 47.4	34 35 40	15.94	23.18
13 10 31.2	35 13 07	21.24	3.66	13 12 51.0	35 21 13	11.40	3.66
13 10 31.3	35 12 57	20.42	3.66	13 12 51.3	35 21 14	20.93	3.66
13 10 32.7	35 12 37	21.20	6.10	13 12 53.6	35 12 21	20.36	4.88
13 10 34.6	35 13 01	21.13	3.66	13 12 56.0	34 39 31	18.28	8.54
13 10 35.1	35 13 32	21.30	3.66	13 12 56.3	34 53 23	17.71	10.98
13 10 35.5	35 24 49	19.23	6.10	13 12 57,5	34 39 56	19.58	4.88
13 10 44.3	34 45 02	22.36	2.44	13 12 58.0	34 40 21	21.50	3.66
13 10 44.6	34 44 55	21.43	3.66	13 12 58.2	34 39 58	18.26	8.54
13 10 44.9	34 45 12	22.11	2.44	13 12 59.7	34 40 44	19.56	4.88
13 10 46.5	34 45 06	21.21	4.88	13 13 02.2	34 44 21	19.37	6.10
13 10 46.6	34 47 16	19.00	6.10	13 13 03.1	35 26 16	17.40	10.98
13 10 46.8	34 37 05	20.18	2.44	13 13 14.8	35 04 28	20.63	4.88
13 10 47.1	34 24 57	18.08	14.64	13 13 22.2	34 48 21	17.46	12.20
13 10 47.4	34 37 26	18.81	8.54	13 13 26.9	35 25 13	19.71	7.0
13 10 50.0	34 37 03	20.57	3.66	13 13 33.6	34 39 26	18.02	12.20
13 10 50.0	34 37 07	19.31	9.76	13 13 36.0	35 05 02	18.55	9.76
13 10 50.4	34 37 15	19.58	3.66	13 13 43.9	35 18 27	14.59	73.20
13 10 51.0	34 36 56	20.71	3.66	13 14 06.8	35 15 11	18.90	12.20
13 10 55.4	34 37 50	17.82	14.64	13 14 07.9	35 15 27	17.36	17.08

Here 82 brighter and more interesting galaxies were chosen for photometry. For the goal a Joyce-Lobel photometry machine at NAO Rozhen was used. The scanning step was 50 x 50 microns = 1 pixel. This gives a scale of the image 0.61 pxis/mm, the scale of the plate being 12.2 arcsec/mm. The photometer wedge on the plate was scanned with the same step. Using a ready made observatory software we transformed all images into readable ones for PC VISTA package programmes format. Most of these objects are small. In a few of them a galactic structure can hardly be seen. Most are seen as spots so we made a ring aperture photometry. The linearization of the images with a photometer wedge and further calculation of the magnitudes were performed at NAO using ready made software and PC VISTA package.

In our case choosing a photometric standard is a puzzling problem. No star can be used because brighter stars for which photometry in literature is available are overexposed. We found only three galaxies in MGC and RC3 catalogues [8-9] that can be seen on our plate too. These are Mk 450,1C 861 and MGC 6-29-69 (=UGC 8338). Mk 450 is an irregular galaxy and it cannot be used as a ring aperture photometric standard. 1C 861 has a double core or a star projected on it so its photometry is difficult. '^*we* use only MGC 6-29-69 as a primer photometric standard. Unfortunately, it is not seen on face, the inclination angle being 45 deg approximately. So all our photometric data can be shifted up or down, not more than 0.5 mag. However, as all data are shifted with the same correction, it is of no importance for the conclusions we made. All magnitudes are accurate up to +/ —0.1 mag.

The astrometry is approximately accurate up to +/ —5". This value is estimated when checking our coordinates of the galaxies Mk 450,1C 861 and MGC 6-29-69 with these given in RC3 [9],

3. Results. Table 1 presents coordinates and photometry for 82 galaxies. An explanation of the columns follows:

1 —number

2, 3 —coordinates alpha, delta for equinox 1950.00

4 —mB total as denned in RC3, not corrected for inclination and galactic extinction

5 —diameter in arcsec of ring aperture in which mB total is calculated. Really this is the optical diameter of the galaxy

6 —remark: dbl —double, cr —core, brer —bright core, sprs —spirals, bar —bar, 1C 861 —a star on it or a double core

Because MGC 6-29-69 is used as photometric standard its mB total is exactly equal to that presented in RC3. In RC3 1C 861 has mB= 15.45 and in this paper it is 15.94. However, both values are doubtful because of the bright star near the galaxy image.

4. Discussion. Figure 1 shows the distribution of the number of galaxies according to the estimated visual magnitude mB. It is seen from the picture that the number of galaxies increases with the decreasing of the visual luminosity up to 20 mag approximately. To the lower magnitudes it decreases sharply, but this is a pure selective effect that reflects not the real picture but the number of galaxies we selected for photometry. As it was mentioned above, there are 362 galaxies more than that we investigated, their magnitudes being fainter than 20 mag, and they are not included in this histogram. So we can say for sure that the function does not really decrease but becomes flat or even continues to increase.

One can use the visual luminosity as a rough distance indicator for very distant galaxies. If a void exists it should be seen on this picture. Figure 1 does not show any suggestions for that. Because this is an approximate method, we would like td| emphasize that we cannot say for sure that a void does not exist. In these data there are no evidences to confirm the presence of a void. Only spectra of all these faint galaxies will give the proper answer to this question.

It is seen even better in Fig. 2. It shows the distribution of the number of galaxies with diameters. We measured the apertures in which mB is calculated as to fit the optical diameter of each galaxy. It is clearly seen that the number of galaxies increases with the decreasing of the visible diameter. A visible diameter can also be used as distance indicator and also there is no evidence for the existing of a void.

The number of the presented data is not sufficient for drawing conclusions about luminosity function and a precise statistical analysis.

5. Conclusion. The following main results and conclusions are presented in this paper:

1. A plate of the void 1312+ 35 on the 2-m RCC telescope at NAO Rozhen, Bulgaria, with 150 min exposition and a very good seeing less than *1"* is received;

2. 444 galaxies are detected on this plate and their coordinates are measured. They are available as a computer catalogue on DECstation machine;

3. Ring aperture photometry for 82 of them is performed. Visual magnitudes and apertures (diameters) are presented;

4. Histograms that show distribution of magnitudes and diameters of galaxies are presented;

5. The main conclusion is: In the presented data there are no evidences that confine the existing of a large space empty of galaxies, e.g. a void in direction with a centW 1312+35(1950).

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