

A SEARCH FOR GALAXIES IN VOID 1312+35

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The observational program proposed by the Max Plank Institute of Astronomy, Heidelberg, Germany and the Department of Astronomy at the Bulgarian Academy of Sciences was successfully continued during the 1991-1992. The main task of the program was to check the lack of galaxies in the region of the VOID 1312+35 [1]. The idea to use the 2 m telescope of the National Astronomical Observatory 'Rozhen'

Table 1

Program list and first results of the joint project with MPIA — Heidelberg 'Searching for galaxies in VOIDS'

| h | m | s | 0 | ' | " | N1 | Plates No | No of gal. | No2 | No2ind. |
|----|----|----|-----|----|----|-----|------------------|------------|-----|---------|
| 00 | 00 | 00 | -12 | 00 | 00 | 35 | | | | 14 |
| 00 | 00 | 00 | 15 | 00 | 00 | 40 | | | | |
| 00 | 00 | 00 | 18 | 00 | 00 | 40 | | | | |
| 00 | 30 | 00 | 12 | 00 | 00 | 30 | | | | |
| 00 | 30 | 00 | 15 | 00 | 00 | 30 | | | | 3 |
| 00 | 30 | 00 | 18 | 00 | 00 | 30 | | | | |
| 00 | 33 | 00 | 06 | 54 | 00 | 50 | | | | 1 |
| 00 | 41 | 00 | 05 | 00 | 00 | 45 | 1862 | | | |
| 00 | 45 | 00 | 04 | 00 | 00 | 45 | 1863, 1868 | | | 2 |
| 00 | 45 | 00 | 05 | 00 | 00 | 45 | 1864 | | | 2 |
| 00 | 45 | 00 | 06 | 00 | 00 | 45 | 1865 | | | |
| 00 | 49 | 00 | 05 | 00 | 00 | 45 | 1867 | | | 2 |
| 02 | 00 | 00 | 13 | 00 | 00 | 35 | | | | 1 |
| 10 | 42 | 00 | 00 | 00 | 00 | 50 | 1896, 7084-CA | 847 | | 6 |
| 13 | 00 | 00 | 35 | 00 | 00 | 45 | 1817 | | | 2 |
| 13 | 06 | 00 | 36 | 00 | 00 | 45 | 1897 | | | 4 |
| 13 | 06 | 00 | 35 | 00 | 00 | 45 | 1899 | 829 | | 16 |
| 13 | 06 | 00 | 34 | 00 | 00 | 45 | 1898, 7082-CA | 791 | | 8 |
| 13 | 12 | 00 | 35 | 00 | 00 | 50 | 1890 | 443 | | 4 |
| 16 | 00 | 00 | 18 | 00 | 00 | 100 | 1830, 1831, 1818 | 1745 | | 5 |
| 23 | 20 | 00 | 13 | 39 | 00 | 50 | 1861 | 279 | | 24 |
| 23 | 30 | 00 | 12 | 00 | 00 | 45 | | | | 11 |
| 23 | 30 | 00 | 15 | 00 | 00 | 45 | | | | |
| 23 | 30 | 00 | 18 | 00 | 00 | 45 | | | | 6 |

Rem: N1 — number of galaxies in 1 sq. degree according Shane, 1975.

N2 — number of galaxies in Huchra's CfA redshift catalog, 1990.

For the fields with the same ALPHA are given the total number of galaxies and the number of galaxies in each field too.

No of gal. — galaxies founded on our plates.

Plates No 7082 and 7084—2.2-m telescope, IIIaJ+GG 385 hypersensitized 4 hours in forming gas.

Plates No 1818, 1868—2 m telescope, 103aF+R—filter.

All other plates—2 m telescope, ZU21+B—filter.

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Table 2
Coordinates of new brighter galaxies in VOID 1312+35

| alpha 1950.00 delta | | | | | | alpha 1950.00 delta | | | | | | | |
|---------------------|----|----|------|----|----|---------------------|----|----|----|------|----|----|----|
| 1 | 13 | 9 | 28.8 | 34 | 51 | 48 | 47 | 13 | 11 | 27.5 | 34 | 31 | 32 |
| 2 | 13 | 9 | 30.7 | 34 | 53 | 52 | 48 | 13 | 11 | 28.5 | 34 | 31 | 34 |
| 3 | 13 | 9 | 33.0 | 34 | 47 | 30 | 49 | 13 | 11 | 29.4 | 34 | 31 | 44 |
| 4 | 13 | 9 | 37.4 | 35 | 2 | 53 | 50 | 13 | 11 | 35.4 | 34 | 42 | 42 |
| 5 | 13 | 9 | 50.7 | 35 | 16 | 54 | 51 | 13 | 11 | 44.5 | 34 | 57 | 43 |
| 6 | 13 | 9 | 51.1 | 34 | 56 | 36 | 52 | 13 | 11 | 49.3 | 34 | 37 | 6 |
| 7 | 13 | 9 | 51.8 | 34 | 57 | 13 | 53 | 13 | 11 | 49.4 | 34 | 37 | 1 |
| 8 | 13 | 9 | 52.9 | 34 | 56 | 14 | 54 | 13 | 11 | 52.0 | 34 | 39 | 51 |
| 9 | 13 | 9 | 55.4 | 34 | 56 | 37 | 55 | 13 | 11 | 52.6 | 34 | 39 | 47 |
| 10 | 13 | 9 | 57.3 | 35 | 16 | 34 | 56 | 13 | 11 | 55.2 | 35 | 23 | 11 |
| 11 | 13 | 9 | 58.3 | 35 | 23 | 14 | 57 | 13 | 11 | 56.8 | 34 | 46 | 20 |
| 12 | 13 | 9 | 59.4 | 34 | 49 | 43 | 58 | 13 | 12 | 10.6 | 35 | 1 | 47 |
| 13 | 13 | 9 | 59.7 | 35 | 23 | 27 | 59 | 13 | 12 | 19.9 | 35 | 18 | 2 |
| 14 | 13 | 10 | 3.6 | 34 | 39 | 17 | 60 | 13 | 12 | 20.8 | 35 | 18 | 3 |
| 15 | 13 | 10 | 5.3 | 35 | 21 | 51 | 61 | 13 | 12 | 25.7 | 35 | 24 | 46 |
| 16 | 13 | 10 | 6.4 | 35 | 3 | 28 | 62 | 13 | 12 | 29.2 | 34 | 48 | 5 |
| 17 | 13 | 10 | 8.2 | 35 | 20 | 34 | 63 | 13 | 12 | 29.3 | 35 | 10 | 11 |
| 18 | 13 | 10 | 8.8 | 34 | 36 | 17 | 64 | 13 | 12 | 29.7 | 35 | 10 | 14 |
| 19 | 13 | 10 | 10.0 | 35 | 20 | 28 | 65 | 13 | 12 | 32.5 | 35 | 19 | 0 |
| 20 | 13 | 10 | 14.5 | 35 | 22 | 45 | 66 | 13 | 12 | 34.6 | 34 | 58 | 4 |
| 21 | 13 | 10 | 15.0 | 34 | 52 | 7 | 67 | 13 | 12 | 47.1 | 34 | 43 | 28 |
| 22 | 13 | 10 | 16.9 | 34 | 32 | 24 | 68 | 13 | 12 | 47.4 | 34 | 35 | 40 |
| 23 | 13 | 10 | 27.9 | 35 | 4 | 14 | 69 | 13 | 12 | 51.0 | 35 | 21 | 13 |
| 24 | 13 | 10 | 31.1 | 35 | 21 | 2 | 70 | 13 | 12 | 51.3 | 35 | 21 | 14 |
| 25 | 13 | 10 | 31.2 | 35 | 13 | 7 | 71 | 13 | 12 | 53.6 | 35 | 12 | 21 |
| 26 | 13 | 10 | 31.3 | 35 | 12 | 57 | 72 | 13 | 12 | 56.0 | 34 | 39 | 31 |
| 27 | 13 | 10 | 32.7 | 35 | 12 | 37 | 73 | 13 | 12 | 56.3 | 34 | 53 | 23 |
| 28 | 13 | 10 | 34.6 | 35 | 13 | 1 | 74 | 13 | 12 | 57.5 | 34 | 39 | 56 |
| 29 | 13 | 10 | 35.1 | 35 | 13 | 32 | 75 | 13 | 12 | 58.0 | 34 | 40 | 21 |
| 30 | 13 | 10 | 35.5 | 35 | 24 | 49 | 76 | 13 | 12 | 58.2 | 34 | 39 | 58 |
| 31 | 13 | 10 | 44.3 | 34 | 45 | 2 | 77 | 13 | 12 | 59.7 | 34 | 40 | 44 |
| 32 | 13 | 10 | 44.6 | 34 | 44 | 55 | 78 | 13 | 13 | 0.1 | 34 | 32 | 9 |
| 33 | 13 | 10 | 44.9 | 34 | 45 | 12 | 79 | 13 | 13 | 2.2 | 34 | 44 | 21 |
| 34 | 13 | 10 | 46.5 | 34 | 45 | 6 | 80 | 13 | 13 | 3.1 | 35 | 26 | 16 |
| 35 | 13 | 10 | 46.6 | 34 | 47 | 16 | 81 | 13 | 13 | 14.8 | 35 | 4 | 28 |
| 36 | 13 | 10 | 46.8 | 34 | 37 | 5 | 82 | 13 | 13 | 22.1 | 34 | 40 | 0 |
| 37 | 13 | 10 | 47.1 | 35 | 24 | 57 | 83 | 13 | 13 | 22.2 | 34 | 48 | 21 |
| 38 | 13 | 10 | 47.4 | 34 | 37 | 26 | 84 | 13 | 13 | 26.9 | 35 | 25 | 11 |
| 39 | 13 | 10 | 50.0 | 34 | 37 | 3 | 85 | 13 | 13 | 26.9 | 35 | 25 | 13 |
| 40 | 13 | 10 | 50.0 | 34 | 37 | 7 | 86 | 13 | 13 | 33.6 | 34 | 39 | 26 |
| 41 | 13 | 10 | 50.4 | 34 | 37 | 15 | 87 | 13 | 13 | 34.8 | 34 | 39 | 11 |
| 42 | 13 | 10 | 51.0 | 34 | 36 | 56 | 88 | 13 | 13 | 36.0 | 35 | 5 | 2 |
| 43 | 13 | 10 | 55.4 | 34 | 37 | 50 | 89 | 13 | 13 | 43.9 | 35 | 18 | 27 |
| 44 | 13 | 11 | 13.1 | 35 | 17 | 11 | 90 | 13 | 14 | 6.8 | 35 | 15 | 11 |
| 45 | 13 | 11 | 13.8 | 35 | 1 | 46 | 91 | 13 | 14 | 7.9 | 35 | 15 | 27 |
| 46 | 13 | 11 | 21.5 | 34 | 40 | 3 | | | | | | | |

with its large field of $1^{\circ} \times 1^{\circ}$ was very fruitful. The first results concerning voids 1600+18 and 2320+1339 can be found in [2] and [3]. The program list contains one comparison field -- the well known cluster of galaxies A 1376 with coordinates (1950): $\alpha: 11^{\text{h}} 40^{\text{m}} 54^{\text{s}}$ and $\delta: +20^{\circ} 07' 00''$ and about two dozens of voids round the centres with coordinates (1950) listed in Table 1. The main surface densities (gal/sqr. deg) according to Shane [4] are shown too.

Using the exposure time ca. 3 h we can reach a limiting magnitude ca. 1.5 lower than the POSS limit, i. e., we may detect fainter objects. The second step will be a detailed study of the most interesting objects listed in Table 2 using the MDM-6 mic-

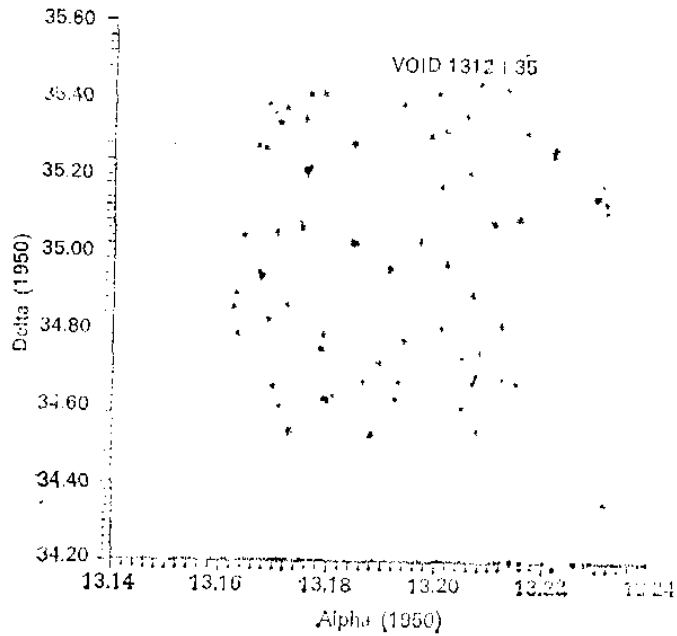


Fig. 1

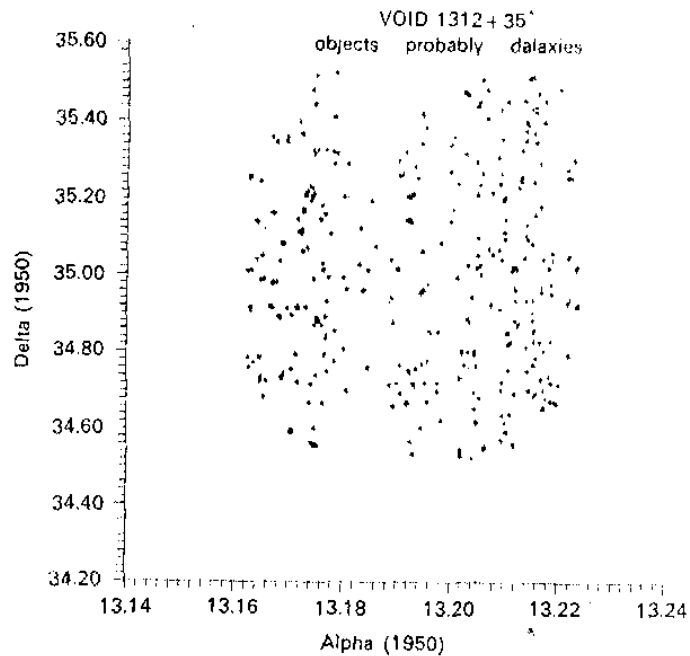


Fig. 2

rodensitometer of NAO 'Rozhen' and CCD-camera of 1.2 and 2.2 m telescopes of the Calar Alto observatory DSAZ, Spain and of the 2 m telescope of NAO.

Three hours plate was taken of the void 1312+35 during the night of April 27, 1992 with a comparatively good view ca. 1--2". The plate No 1890 was measured using ASCORECORD measuring machine in Sofia. The SAO stars were used as first standards taken with OVERLAY program, running on VAX in Heidelberg, Germany. A PASCAL (A. S.) program for the plate reduction for PC was used to convert the rectangular coordinates of the measures objects to equatorial ones for the equinox 1950.

Some qualitative evaluations can be made for the objects, measures on the plate No 1890. 443 galaxies altogether in the field 1312 +35 were measured. Table 2 consists of 91 brighter and more interesting galaxies. In addition 352 galaxies were measured. The mean surface density in this case is ca. 400 (gal/sqr. deg) — see Table 1 for comparison. The distributions of the newly measured galaxies are shown in Fig. 1 and 2

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REFERENCES

¹ R o o d H. J. Ann. Rev. A & Ap., 26, 1988, 631-686. ² P e t r o v G., B. K o v a c h e v Compt. rend. Acad. bulg. Sci., 45, 1992, No 6, 5-8. ³ K o v a c h e v B., G. P e t r o v. Ibid., 45 1992, No 9, 9-10. ⁴ S h a n e C. D. In: Galaxies and the Universe. (Eds A. Sandage, M. Sandage J. Kristian). Univ. of Chicago Press, 1975, 647-663.

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