

Surface Photometry of the Spiral Arms of M51

G.R.Ivanov and M.S.Toropova

Department of Astronomy, University of Sofia

Sternberg Astronomical Institute, Moscow

Abstract. Surface photometry of M51 galaxy was made. The brightest details are identified with HII regions. They are similar to the OB associations in nearby galaxies.

The M51 galaxy is a subject of intensive study. It is very convenient for studying the nature of the spiral arms. The aim of the present paper is to obtain more detailed picture of the spiral arms by means of surface photometry.

A B plate of M51 was taken in January 1983 at National Rozhen observatory by the 2m RCC telescope. The isodenses were obtained by photographic method of Brejdo and Tchebatazeva (1966) and Sitnik and Toropova (1982). Three of them outlined the optical feature best. They are shown in Figure 1. Each isodense was calibrated in B mag. per square second μ_B by using the profiles of the system M51 (NGC 5194 + NGC 5195) according to Burkhead (1978). HII regions are marked in Figure 1 following the numeration given in the paper of Pronic and Ichuvaev (1971). It is evident that many bright details in B system are connected with HII regions. The correlation between the OB stars and HII regions is expected. These stars provide the excitement of the interstellar gas. The large scale distribution of the HII regions given by Tully (1974) also shows a narrow correlation with the blue bright features in Figure 1. This coincidence shows that most of the details indicate the regions of OB stars. It is possible the distribution of the bright details in Figure 1 to due to OB stars.

The OB associations consist of about 20 OB stars. Their characteristic dimensions are 100 pc. The mean surface brightness of the bright stellar associations in M33 is $\mu_B = 20.3$ (Ivanov, 1987). The extensive fragments of the spiral arms consisting of several OB associations with a mean size 600 pc were nominated by Efremov (1982) star complexes. Their surface

brightness is $\mu_B = 22.0$.

The thick isodense in Figure 1 corresponds to $\mu_B = 20.3$. It outlines about 40 details. Most of them are connected with HII regions. Their mean size is about 100 pc. We believe that the isodense with $\mu_B = 20.3$ outlines the bright OB associations. The number of the bright associations in M33 is 43.

The thin line in Figure 1 represents the isodense with $\mu_B = 21$. It corresponds to the surface brightness of the bright star complexes. The dimension of the three largest details with isodense $\mu_B = 21$ visible only in the eastern arm are about 1 kpc. They coincide with the extensive Tully's HII regions. It seems that the three brightest star complexes in M51 remind of the strong extensive star complexes in the spiral arms of M31 and M33. We conclude that the bright details in spiral arms of M51 are candidate stellar associations and star complexes. A further observations are planned to search spiral structure of M51.

We are grateful to Yu. Efremov for the comments and the valuable discussions.

References

- Brejdo, I.I. and Tchebotareva, I.P.: 1966, *Izvestija GAO of Soviet Academy of Sciences* 24, 159.
- Burkhead, M.S.: 1978, *Astrophys. J. Suppl.* 38, 147.
- Efremov, Yu.N.: 1982, *Astron. Zh. Letters* 8, 585.
- Ivanov, G.R.: 1987, *Astrophys. Space Sci.* 136, 113.
- Pronic, I.I. and Tchuvaev, K.K.: 1971, *Izvestija of Crimean Astrophysical Observatory* 43, 101.
- Sitnic, I.T. and Toropova, M.S.: 1982, *Astron Zh. Letters*, 8, 679.
- Tully, R.B.: 1974, *Astrophys. J. Suppl.* 27, 449.

Figure Caption

Figure 1. Three isodenses are outlined. The number represent HII regions of Pronic and Tchuvaev (1971).

