NEW DATA ON THE PECULIAR GALAXY MRK 273

A. S. Asatrian and A. R. Petrosian
Byurakan Astrophysical Observatory, ARMENIA

F. Börngen
Tautenburg Observatory, DDR

ABSTRACT. On the basis of direct UBV and spectral observations at Tautenburg (DDR) 2m and Special Observatory (USSR) 6m telescopes respectively the colorimetric and spectral investigations of the megamaser galaxy MRK 273 are carried out. It is seen that: MRK 273 is in a physical group of galaxies, which contains at least five members. Two bright central condensations of MRK 273 are Seyfert nuclei. The area of the main body of MRK 273 which contains both Seyfert nuclei and from which comes out a straight tail, is redder than the remaining part of the galaxy. The tail has a pronounced blue color and most probably radiates in [OIII] λ5007 line. Observed radio continuum, OH and HI absorption features are related to bright "a" nucleus of galaxy. We come to the conclusion that MRK 273 which is the member of the group of the galaxies is itself a close system of two objects with AGNs. The tail, with radiation being of thermal origin, probably is the result of the interaction of these galaxies.

INTRODUCTION - OBSERVATIONS AND PROCESSING

MRK 273 is one of the most interesting galaxies in the Markarian lists. It is a megamaser (Baan et al. 1985) and ultraluminous infrared galaxy (Sanders et al. 1988) with peculiar morphological structure (Korovyakovskij et al. 1981) and with an AGN (Kachikian and Weedman 1974). In the present work detailed spectral and colorimetric investigations of the MRK 273 are carried out on the basis of high resolution spectra and direct UBV observations.

Direct UBV observations at the Schmidt focus of the Tautenburg observatory 2 m telescope are carried out. A selected combination of the plates and the UBV filters ensures system very close to the international. Plates were processed on the complex PDS1010A+SM4 of Byurakan Observatory with the scanning diagram 0.5 x 0.5 arcsec. The mean accuracy of the surface photometry was estimated as $0^{m}.07 \pm 0^{m}.06$.

Spectra for MRK 273 and its neighbors at the prime focus of the Special Observatory 6 m telescope, with spectral resolution about 6A and for seeing 1.5-2 arcsec (spatial scale is about 17 arcsec per mm) are carried out. The stars BD 25°3941 and Feige 92 (Stone 1977) were used for comparison.

A copy of the field around MRK 273 from the B plate of the 2 m telescope is presented in Figure 1a. Observed neighbors of MRK 273 are identified in it. Two positions of the spectrograph slit and three condensations in main body of the galaxy are indicated in Figure 1b on an isodensitometric picture of MRK 273 (Korovyakovskij et al. 1981).

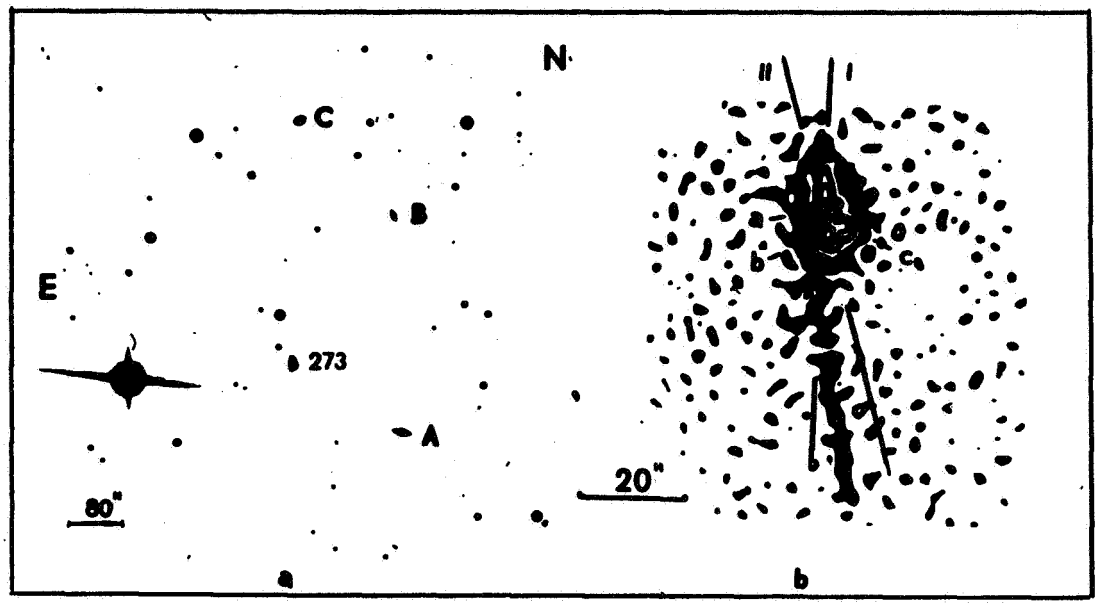

Figure 1.

RESULTS

In the spectra of all three neighbors of MRK 273 absorption lines of Ca+ H and C and G band are identifed. In Table 1 are presented radial velocities of MRK 273 and its three neighbors corrected for the solar motion, their total B magnitudes and colors as well as morphological classes.

Table 1.

Galaxy	Other name	V ($km \cdot s^{-1}$)	B	U-B	B-V	Morph.
MRK 273	MCG 9-23-4	11730	14.90	0.05	0.75	Pec.
A neighb.	MCG 9-23-2	11700	15.41	0.44	0.90	SO
B neighb.		12150	16.95	0.32	0.96	Sa
C neighb.	MCG 9-23-2	11480	15.93	0.05	0.82	Sbc

With the first position of the spectrograph slit we had spectral information about the tail and the main body of MRK 273. In Figure 2 an isodensitometric picture of the spectral region [OIII] λ5007 - H_β for MRK 273 for the first position of the slit is presented. Continuum radiation of the main body of MRK 273 is strong. Emission lines with composite structure are broadened. The tail obviously does not radiate in continuum but its radiation exists in [OIII]λ5007 line after subtraction of the night sky [NI]λ5200 line intensity.

For the second position of the spectrograph slit the spectra of the "a" and "b" condensations of MRK 273 are clearly separated. Both condensations show broad emission lines with corrected FWHM as 780±90 $km \cdot s^{-1}$ respectively. To characterize the dominant energy source producing the line emissions in both condensations we have followed the work of Veilleiux and Osterbrock (1987) using line ratios - ([OIII]λ5007)/Hβ, ([SII]λ6716+6731)/Hα, (NII]λ6583)/Hα and ([OI] λ6300)/Hα. Both condensations of MRK 273 fall clearly within the line ratio characteristics of Sy2 type AGNs.

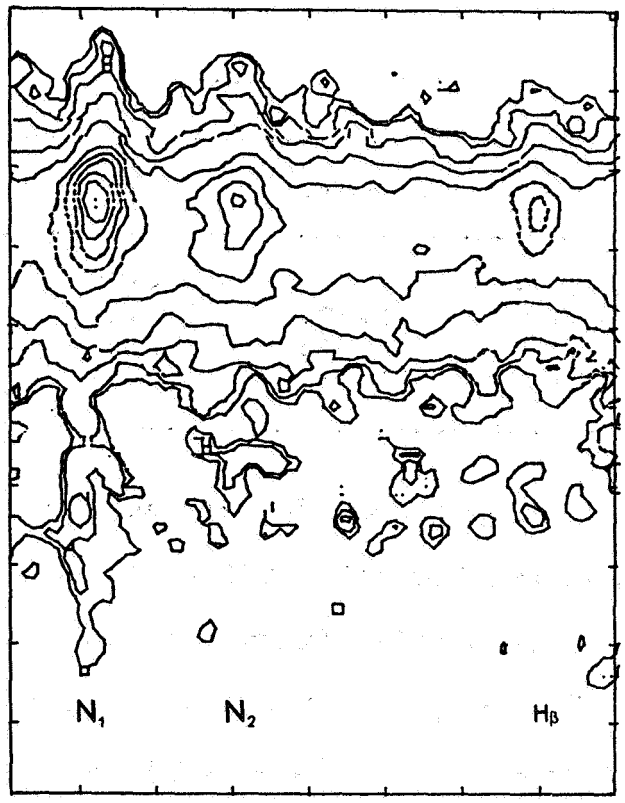

Figure 2.

In Figure 3 a contour map of MRK 273 in (U-B) color is presented. On the map by solid lines the (U-B) <0 and by dotted lines the (U-B) > 0 values are marked. As is seen in Figure 3 the area of the main body of MRK 273 which contains both Seyfert nuclei and from which the straight tail comes out is redder than the remaining part of the galaxy. The tail has a pronounced blue color with two or three comparatively red condensations.

DISCUSSION

The data of Table 1 show that MRK 273 and its three neighbors are physically related. As mentioned by Sanders et al. (1988) there is another starlike blue galaxy approximately 40" north of the main body on a direct line with the tail of MRK 273,

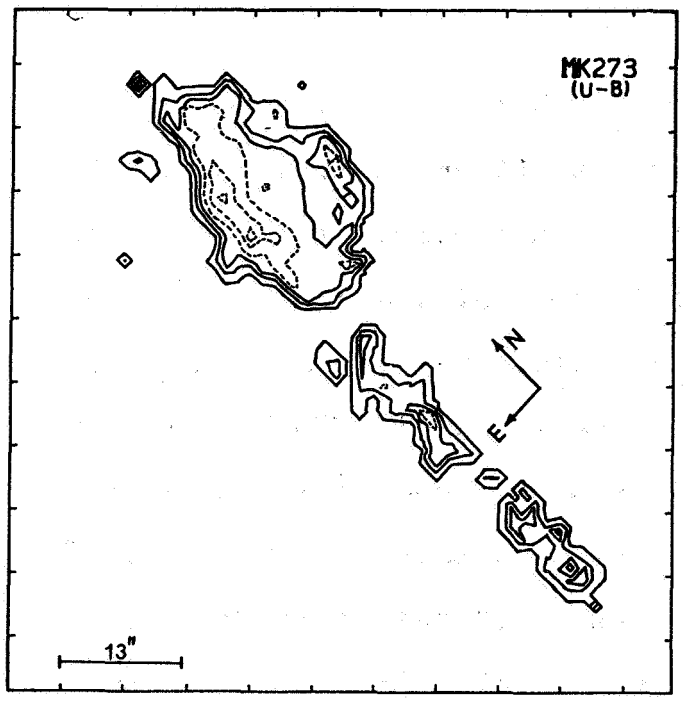

Figure 3.

whose redshift is only 50 km•s^{-1} different from that of MRK 273. We identified this object on the direct plates from the Tautenburg Observatory 2 m and Byurakan Observatory 2.6 m telescopes with a starlike object not at 40" but about 80" north from the main body of MRK 273. So MRK 273 with at least four other galaxies forms a physical group of galaxies. This can be an additional proof that all megamasers are members of the groups or clusters of galaxies (Henkel et al. 1987).

It is well determined that all ultraluminous infrared galaxies, including megamasers, are interacting or merging systems (e.g. Henkel et al. 1987; Sanders et al. 1988). Our data allow to suppose that MRK 273 is a close system of two probably disk type objects with AGNs, in which it resembles ARP 220 (Diamond et al. 1989). By color the third-"c" condensation probably is a giant HII region and the straight tail is the result of the interaction of these galaxies.

Because of blue color and the probable presence of [OIII] 5007 line in its spectra the latter looks by nature like a spiral arm containing young stars and ionized gas in abundance.

On plates of 2 m telescope with accuracy $\pm 0^{s}.666$ and $\pm 0''.21$ by right ascension and declination the positions of three condensations in MRK 273 are measured. The comparison of the measured optical positions of the condensations with high resolution radio, OH and HI data show that the bright radio component in 6 cm map of VLA-A (Ulvestad and Wilson 1984), megamaser emission (Schmelz et al. 1987) and HI absorption features (Schmelz et al. 1988) are related to the "a" nucleus of MRK 273. The second compact radio source (Ulvestad and Wilson 1984) is not identified with any optical detail in MRK 273. As in the case of the double nuclei of MRK 463 it may be related to some other, strongly reddened, invisible condensation (Neff and Ulvestad 1988) or, as in the case of MRK 266, it might be conditioned by interaction between galaxies (Mazzarella et al. 1988).

REFERENCES

Baan, W. A., Haschick, A. D., and Schmelz, J. T. 1985, Astrophys. J. Letters, **298**, L51.

Diamond, P. G., Norris, R. P., Bean, W. A., and Booth, R. S. 1989, Astrophys. J. Letters, **340**, L49.

Henkel, C., Gusten, R., Baan, W. A. 1987, Astron. and Astrophys, **185**, 14.

Khachikian, E. E. and Weedman, D. W. 1974, Astrophys. J., **192**, 581.

Korovyakovskij, Y. P., Petrosyan, A. R., Saakyan, K. A., and Khachikian, E. E. 1981, Astrophysics, **17**, 121.

Mazzarella, J. M., Gaume, R. A., Aller, H. D., and Hughes, P. A. 1988, Astrophys. J., **333**, 168.

Neff, S. G., and Ulvestad, J. S. 1988, Astron, J., **96**, 841.

Neugebauer, G., and Scoville, N. Z. 1988, Astrophys. J., **325**, 74.

Sanders, D. B., Soifer, B. T., Elias, J. H., Madore, B. F., Matthews, K., Neugebauer, G., Scoville, N. Z. 1988, Astrophys. J., **325**, 74.

Schmelz, J. T., Baan, W. A., and Haschick, A. D. 1987, Astrophys. J., **321**, 225.

Schmelz, J. T., Baan, W. A., Haschick, A. D. 1988, Astrophys. J., **329**, 142.

Stone, R. P. S. 1977, Astrophys. J., **218**, 767.

Ulvestad, J. S. and Wison, A. S. 1984, Astrophys. J., **278**, 544.

Veilleux, S. and Osterbrock, D. E. 1987, Astrophys. J. Suppl. Ser., **63**, 295.