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Gas Kinematics of the Disk and Bar of the Galaxy Mrk 533

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1. Observations

The Seyfert 2 galaxy Mrk 533 has the morphological description of SA(r)bc pec in RC3 and SBb in UGC. It is a member of the compact group of galaxies H96. Radio observations (Unger et al. 1988) show three radio sources.

3-D observations with a Fabry-Perot scanning interferometer (the number of spectral channels is 32 by 0.44 Å, angular size of 1 px is $0''.47$, the accuracy of radial velocity determination is 10 km s^{-1}) and multi-pupil integral spectrograph observations (the dispersion is 1.16 Å px^{-1}, lens array is 10×16, angular size of each lens is $1''.3 \times 1''.3$) were obtained in the red spectral range at the 6-m telescope. The estimated seeing was about $2''$. In the central region of the galaxy ($r \leq 5''$, interferometer observations) the Hα line profile was fitted by two Gaussians. The first component, K1, corresponds to the galaxy disk. The second component, K2, is visible only in the central part and is brighter than K1 in the same pixels. Profiles of Hα and [NII] λ6584/48 (integral spectroscopy observations) were fitted by two Gaussians. They are a broad component in Hα and [NII] with FWHM $\sim$ 1000 km s^{-1} and a narrow component of three times less FWHM. The lower spectral resolution of this observation made it impossible to separate the narrow component into the two ones visible in the Fabry-Perot observations.

2. Results

The continuum image of the central part of the galaxy ($13''\times 3''.5$) shows the elongation of isophotes along P.A. = $-70°$. The position angle of the line of nodes ($-51°$), the inclination of the galaxy plane towards the sky plane ($20°$), and the position and radial velocity (8700 km s^{-1}) of the dynamical center were determined by the K1 component radial velocity field. The K1 dynamical and photometric centers are the same. A rotation curve with these parameters is shown in Figure 1. The dashed line is an accepted average curve.

Deviations from the average rotation curve in different sides are seen in the outer parts of the galaxy along the line of nodes. The direction to the next galaxy of the group does not differ much from the direction of the line of nodes. Possibly this effect is a result of interaction with the neighbor galaxy and corresponds to the curvature of the galaxy plane.

The decrease of the position angle of the lines of nodes inside of $r < 8''$ reveals the presence of non-circular motion. Isophotes of the monochromatic K1 image (a) and the result of the subtraction of average circular rotations

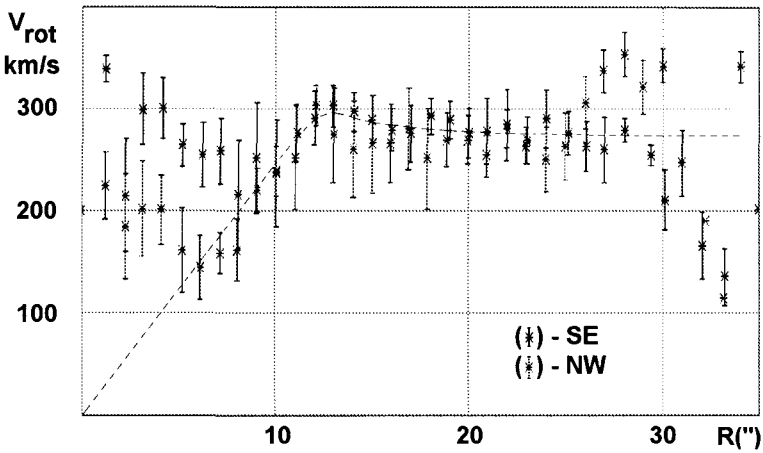

Figure 1. Rotation curve of the disk in the K1 component of Mrk 533

from the K1 velocity field (b) are shown in Figure 2. The residual velocity field shows two symmetrically placed maxima projected onto two bright arcs in the monochromatic galaxy image. These arcs are situated on the opposite sides of the bar and look like the response to a barred galaxy potential (Athanassoula 1988). The NW arc is easily seen in the image of the narrow Hα component from the integral spectrograph observations (Figure 2c).

The same procedure of circular rotation subtraction was carried out for the K2 component. This component image is smooth. A directed change of the velocity of +150 km s^{-1} from NW to SE is determined. The shift of the photometric centers of the K1 and K2 components is noticeable ($\sim 1''$ in the E-W direction). The K2 component can be connected with the outflow from the center and the structure in the radio range, since the position angle and angular distance of these components are similar to the radio image. The low angular resolution of our observations does not allow us to identify this more exactly.

The galaxy images in Hα and [NII] of different components in the integral spectroscopy observations are similar. Their photometric centers coincide with each other and with the photometric center of the continuum image. The broad component with FWHM $\sim$ 1000 km s^{-1} has a blue shift of $\sim$ 450 km s^{-1} with respect to the narrow component. In the center both narrow and broad components (numbers on the Figure 2c, d) have the same ratio of Hα/[NII] ($\sim$0.9).

3. Conclusions

- Mrk 533 shows in the outer parts of the disk the influence of the neighbor galaxy.

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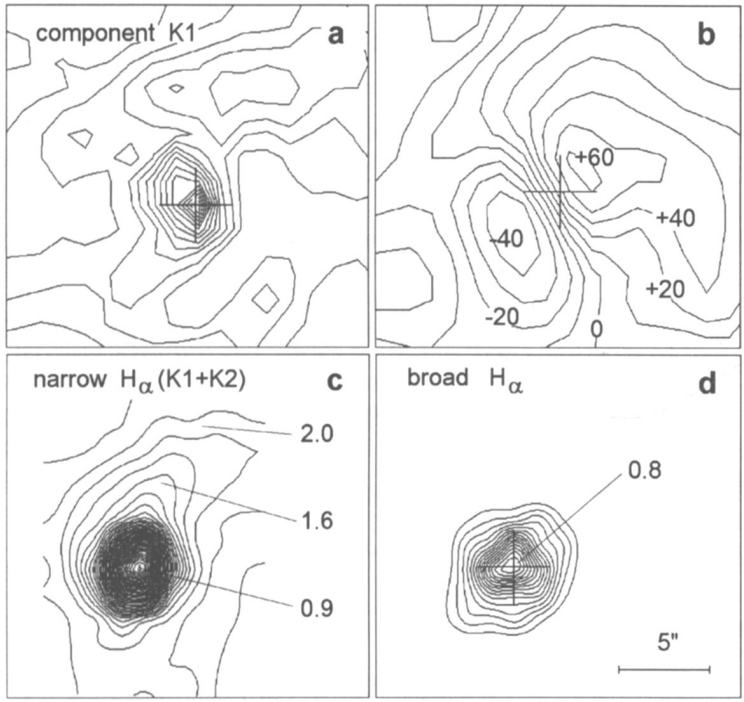

Figure 2. Morphology and kinematics of the circumnuclear region of Mrk 533

- Mrk 533 has a low-contrast photometric bar which is probably initiated by a satellite; two arcs in the outer parts of the bar can be explained by shock waves at the boundary between the disk and faster rotating bar.
- in the central part of Mrk 533 the profiles of Hα and [NII] lines show a broad and a narrow component; the narrow component in turn is divided into two - one of them corresponds to the galaxy disk; motions connected with radio structure are seen.

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References

Athanassoula, E. 1988, in Towards Understanding Galaxies at Large Redshift, R. Kron & A. Renzini, Dordrecht: Kluwer, 111

Unger, S. W. et al. 1988, MNRAS, 234, 745