THE INTERACTING PAIR MKN 305/306

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Direct images and spectra at different slit positions of the interacting system Mkn 305/306 are discussed. Both galaxies show starburst properties due to tidal interaction. The morphology and velocity structure of Mkn 306 reveals the strongest warp of a stellar disk so far known.

The galaxies Mkn 305 and Mkn 306 form a double system with 30 arcsec separation and having a common envelope at $m_B \geq 24.5$. Furthermore a small tidal tail west of Mkn 306A, an isophote twist of Mkn 305 and the near identical redshifts of the two galaxies prove that this is a physical pair. Mkn 306 itself was classified as a double nucleus galaxy (Petrosyan et al., 1978). The optical morphology of Mkn 306 has the form of an integral sign which is

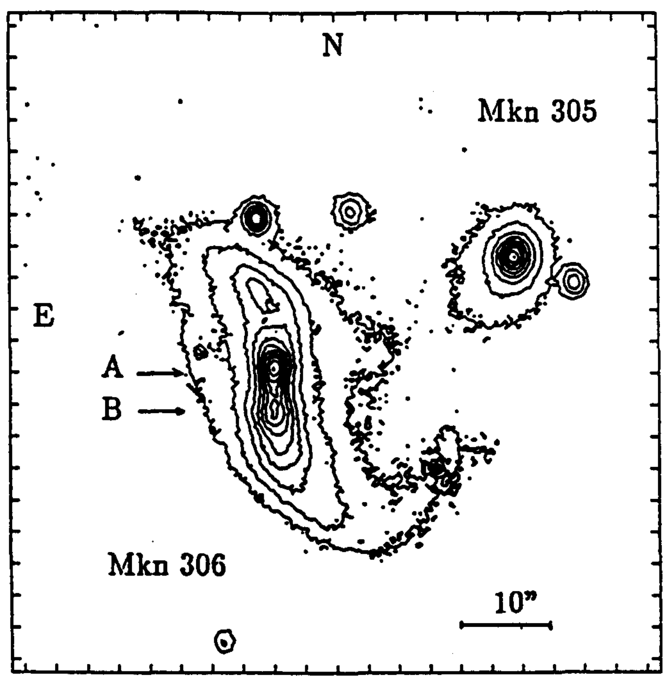

Fig. 1 — Contourplot of the interacting galaxy system in the B-band

similar to the radio morphology of strongly warped galaxies (Bottema et al., 1987). But in the optical the warp of the stellar component is normally far weaker than in the radio for the HI-gas. Therefore we investigated whether the double nucleus structure of Mkn 306 is real

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or an artefact due to an extreme warp in the optical. The origin for the warp phenomenon is not clear yet: merging, tidal interaction or accretion of intergalactic matter (IGM).

Direct images of the galaxy system were taken with the Calar Alto 2.2m telescope in the B-band (Fig. 1) and at La Silla in the r-band using the 2.2m telescope; low dispersion spectra (240 Å/mm) as well as high dispersion spectra (56 Å/mm) for studying the velocity field were taken with the Calar Alto 3.5m telescope at different position angles. Also a spectrum of Mkn 305 was taken at Calar Alto with the 3.5m telescope covering the whole spectral range (240 Å/mm) .

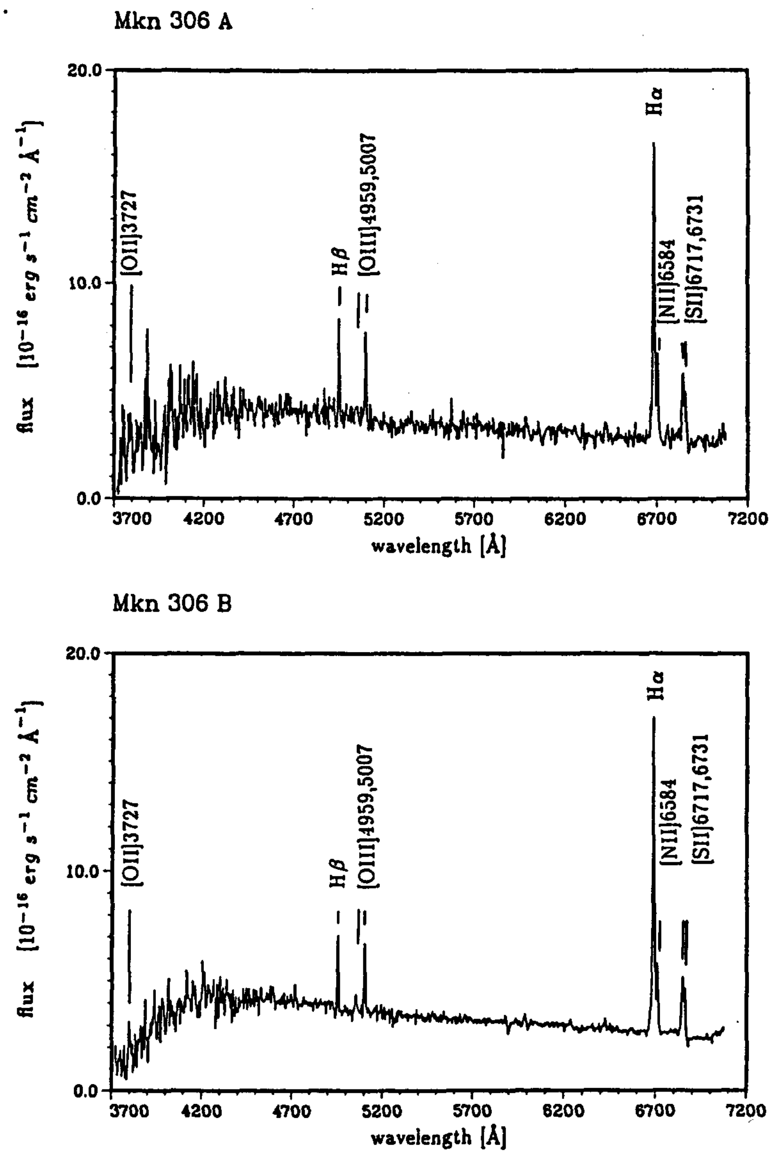

Fig. 2 — Optical spectra Mkn 306 A, B

Redshifts of z=0.0195 for Mkn 306 (m_B=14.6) and z=0.0194 for Mkn 305 (m_B=16.8) were determined from the emission and absorption lines, leading to a distance of D=77.7 Mpc for the system (H_o=75 km s^{-1} Mpc^{-1}). The two central emission regions of Mkn 306 are

Mkn 305

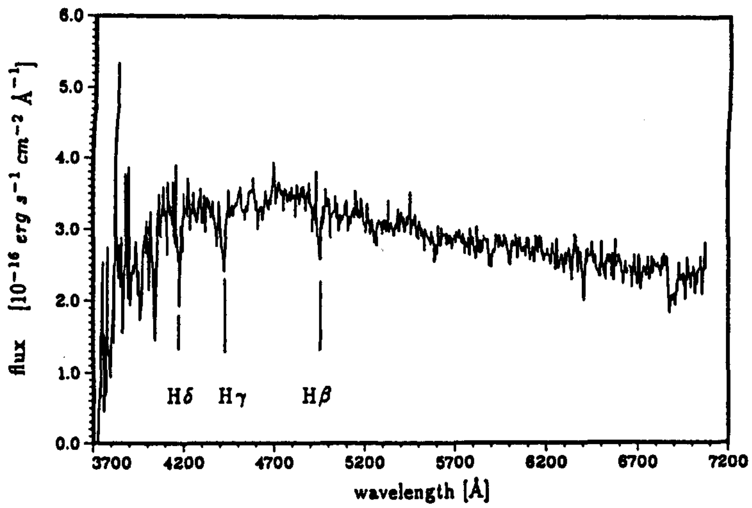

Fig. 3 — Post starburst spectrum of Mkn 305

separated by 5.6 arcsec corresponding to 2.1 kpc. The projected separation of Mkn 305 and Mkn 306A amounts to 12.4 kpc.

The spectra of Mkn 306A and B (Fig. 2) are typical for starburst activity with respect to their line intensity ratios of I([OIII]5007)/I(Hβ) vs. I([NII]6584)/I(Hα) or I([OI]6300)/I(Hα) (Veilleux and Osterbrock, 1987). The overall spectrum from the radio to the optical range shows a FIR-excess typical for dust re-emission of a strong starburst. The observed spectrum of Mkn 305 can be characterized as a post-starburst spectrum (Fig. 3); this is very unusual considering the elliptical morphology of this galaxy.

The velocity field of Mkn 306 was determined parallel (Fig. 4) and perpendicular to the major axis. A comparsion of these velocity measurements correspond very good with the observations and theoretical model calculations of Brinks (1985) for the warped radio velocity field of NGC 224. The warp leads to an additional linear velocity structure with a smaller gradient in the central region of the galaxy in comparison to 'normal' velocity gradients. The superposition of both velocity curves results in a stepwise velocity structure. Model calculations show the existence of a warp and the projection effect simulating the double nuclear structure of Mkn 306. In addition the velocity curves perpendicular to the major axis of Mkn 306A and B which are anti-symmetrical prove this result.

Furthermore the optical morphology of Mkn 306 is very similar to the radio morphology of NGC 4013 (Bottema et al., 1987). Both galaxies are shaped like an integral sign and show double nucleus structure due to the strong warp. In the case of Mkn 306 the warp was induced by means of tidal interaction with Mkn 305.

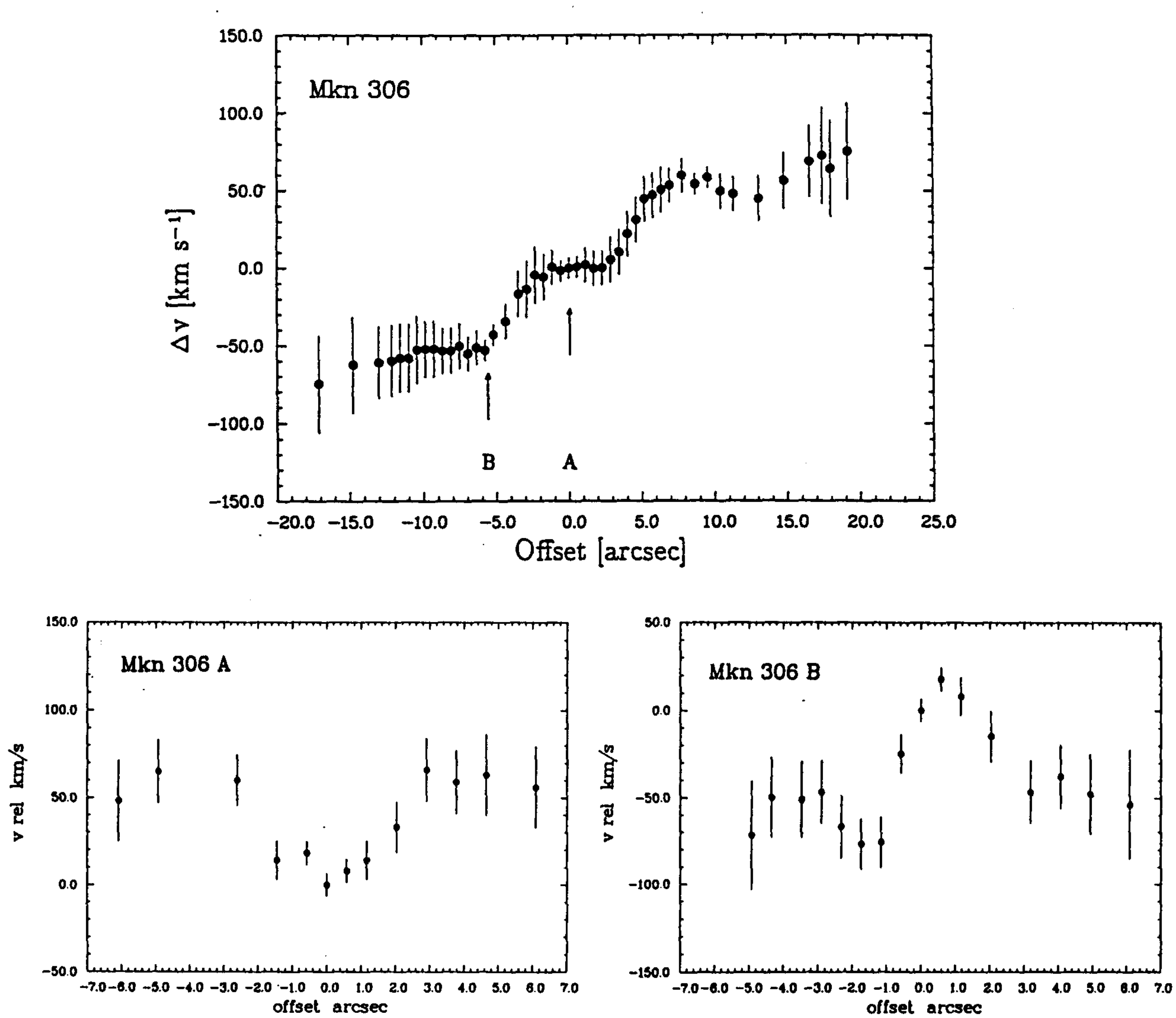

Fig. 4 — Observed velocity curve of Mkn 306 parallel and perpendicular to the major axis

The possibility of being a double nucleus galaxy representing the late stage of an interaction process of two different host galaxies can be excluded taking into account the symmetry of the velocity field and the physical similarities of the two nuclei: their emission line ratios, the relative abundances, the dust content and even the Hα-luminosity and the deduced number of OB-stars (Kollatschny and Dietrich, 1990).

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