

MARK III VLBI OBSERVATIONS OF THE NUCLEUS OF M81
AT 2.3 AND 8.3 GHz

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The normal spiral galaxy M81, which has some characteristics of a Seyfert (Peimbert, Torres-Peimbert, 1981), has a flat spectrum in the radio range (de Bruyn *et al.*, 1976), variable on the time scale of days (Crane *et al.*, 1976), and detectable radiation at infrared (Rieke, Lebofsky, 1978) and X-ray wavelengths (Elvis, van Speybroeck, 1981). At a distance of ~ 3.3 Mpc, M81 is the nearest extragalactic object with a nucleus detectable with VLBI (Kellermann *et al.*, 1976). We report here on simultaneous VLBI observations made with the Mark III system at 2.3 and 8.3 GHz. Observations on 14 and 16 March 1981 utilized the 100 m diameter telescope in Effelsberg, W. Germany (MPIR); the 43 m telescope at Green Bank, WV (NRAO); and the 40 m telescope near Big Pine, CA (OVRO).

Observations with the MPIR antenna yielded total flux densities per beam area of 135 ± 15 mJy at 2.3 GHz and 82 ± 7 mJy at 8.3 GHz. The visibility curve for the MPIR-OVRO baseline is a smooth function with a deep minimum at ~ 14.5 and 16.1 hours GST at 2.3 and 8.3 GHz, respectively. The nucleus is unresolved at 2.3 GHz in the direction of its minor axis on the longest baseline, whereas it is partly resolved at 8.3 GHz. Parameters of elliptical-gaussian models of the brightness distribution at the two radio frequencies were estimated from the corresponding fringe amplitudes. The models are superimposed concentrically in Fig. 1, juxtaposed to a photograph of M81 taken from Sandage (1961). The position angle (PA) of the nucleus, though frequency dependent at the 4σ level, is closely aligned with the rotation axis of the galaxy (PA = $62 \pm 3^\circ$; Rots, Shane, 1975).

Parameters of Elliptical-Gaussian Models of the Brightness Distribution of M81 (quoted errors are purely statistical)

Parameters	2.3 GHz	8.3 GHz
peak flux density (mJy)	58.2 ± 2.6	76.0 ± 4.9
peak brightness temp. (10 ¹⁰ K)	2.6 ± 0.6	1.0 ± 0.1
major axis (mas, FWHM)	1.3 ± 0.1	0.53 ± 0.03
minor axis (mas, FWHM)	0.6 ± 0.1	0.36 ± 0.03
pos. angle of major axis (°)	75.0 ± 3.4	50.0 ± 4.9

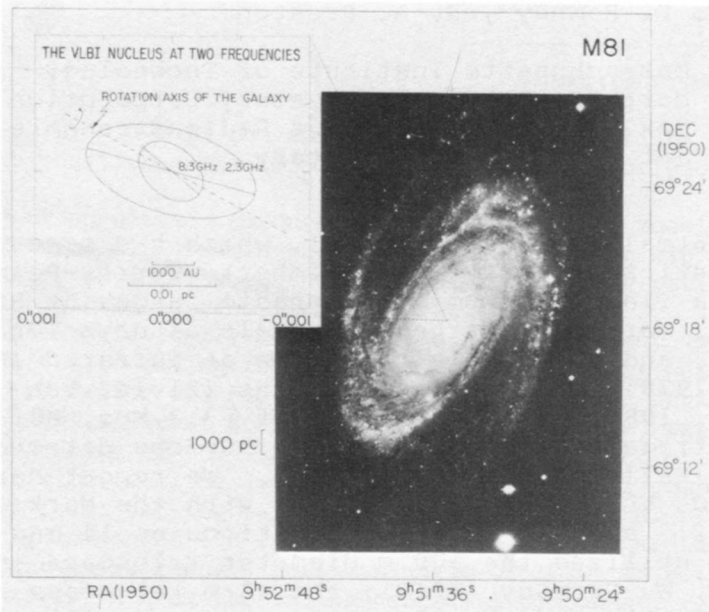


Figure 1: The galaxy M81 with its compact radio nucleus

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REFERENCES

- Bruyn, A. G. de, *et al.* 1976, *Astr. Ap.* **46**, 243.
 Crane, P. C., *et al.* 1976, *Ap. J. Lett.* **203**, L113.
 Elvis, M., van Speybroeck, L. 1981, *BAAS* **13**, 550.
 Kellermann, K. I., *et al.* 1976, *Ap. J. Lett.* **210**, L121.
 Peimbert, M., Torres-Peimbert, S. 1981, *Ap. J.* **245**, 845.
 Rieke, G. H., Lebofsky, M. J. 1978, *Ap. J. Lett.* **220**, L37.
 Rots, A. H., Shane, W. W. 1975, *Astr. Ap.* **45**, 25.
 Sandage, A. 1961, *The Hubble Atlas of Galaxies*, Carnegie Inst. Pub. No. 618.