

AUSTRALIA TELESCOPE OBSERVATIONS OF EXCITED-STATE OH TRANSITIONS IN THE SOUTHERN EDGE-ON SPIRAL NGC 4945

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As part of the Australia Telescope's commissioning astronomy, three antennas of the Compact Array, with spacings of 0.5, 1.5 and 2 km, were used to produce the instrument's first spectral-line images - OH excited-state transitions from the southern spiral galaxy NGC 4945. For the 6030- and 6035-MHz transitions of the ${}^2\Pi_{3/2}$, $J = 5/2$ state, well-defined line absorption was detected towards the 6×2 arcsec² radio continuum nucleus. The line profiles are wide, with heliocentric radial velocities extending from 350 to 770 km s⁻¹, and with overall shapes similar to the corresponding ground-state transitions at 1665 and 1667 MHz (Whiteoak & Gardner 1975). The respective maximum line-to-continuum ratios of 0.04 and 0.07 occur near 650 km s⁻¹. A comparison of the 6035- and 1667-MHz results yields an OH temperature of 36 K. The position of the absorption changes systematically with velocity along a line at position angle 45°. Such behaviour is consistent with that for a rotating molecular cloud which surrounds the nucleus.

Previously, the 6-GHz transitions (which were also detected in NGC 253) had been observed in only one other galaxy - the megamaser galaxy IC 4553 (Henkel, Batrla & Gusten 1986).

Unlike the situation for megamaser galaxies (Henkel, Gusten & Baan 1987), no emission or absorption exceeding a flux density of 0.01 Jy was detected at the 4.7-GHz transition frequencies of the ${}^2\Pi_{1/2}$, $J = 1/2$ excited-OH state. The difference may be due to the higher infrared luminosities of the nuclei of the megamaser galaxies - the luminosity for NGC 4945 may not be high enough to sustain adequate excitation of the 4.7-GHz state.

REFERENCES

Henkel, C., Batrla, W. & Gusten, R., 1986. *Astr. Astrophys.*, **168**, L13.
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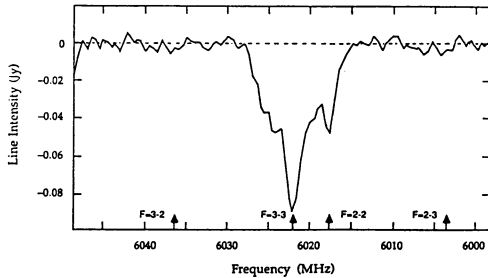


Fig. 1 The ${}^2\Pi_{3/2}$, $J = 5/2$ excited-state OH spectrum; the spectral resolution is 25 km s⁻¹. Arrows mark the relative positions of the four transitions associated with the energy state.

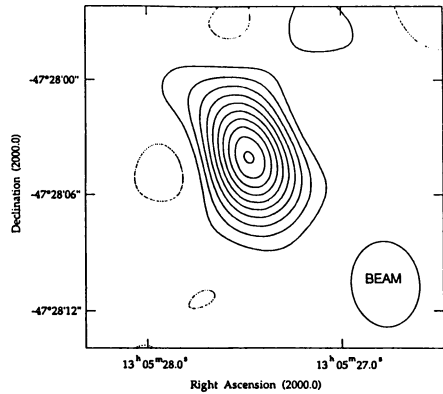


Fig. 2 Image of 6035-MHz OH absorption at a velocity of 655 ± 25 km s⁻¹. The contour levels are -10 (dashed) 10, 20 --- 90, 99 % of the peak intensity of 0.068 Jy beam⁻¹.