PKS 1413+135: A VERY YOUNG RADIO GALAXY

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PKS 1413+135 is an enigma: while classified as a BL Lac due to its polarized near-IR continuum (Stocke et al. 1992) and optical spectrum (Beichmann et al. 1981), it appears to lie within a spiral host (McHardy et al. 1991, Stocke et al. 1992). In addition, the AGN is highly obscured (Beichmann et al. 1981, Carilli et al. 1992, Stocke et al. 1992, Wiklind & Combes 1994, 1995). Yet there is no evidence that the absorbing gas is being heated and re-emitting the AGN radiation in the form of thermal IR or emission lines (as in, e.g., Sey 2s). This led Stocke et al. (1992) to suggest that the AGN might be background to the optical galaxy.

We present VLBA maps of PKS 1413+135 at 3.6, 6, 13, and 18 cm from observations made on July 10-11, 1994 (Figure 1). Its structure appears similar to classical wide-angle-tail (WAT) radio galaxies, but on a much smaller scale. PKS 1413+135 is likely a CSO (see Readhead, this volume).

Our maps firmly establish the location of the core: Component N has an extremely inverted spectrum, well-fit by a power law of index $\alpha = +1.7$ ($S_\nu \propto \nu^\alpha$). This implies that N is likely self-absorbed (e.g. Miley 1980). While the majority of the extended structure is steep-spectrum ($\alpha \leq -1$), several of the knots and bends are somewhat flatter-spectrum, indicative of reacceleration and/or recollimation. The most far-flung components are the steepest, with power-law indices approaching $\alpha = -2$, perhaps due to synchrotron losses (e.g. Jaffe & Perola 1973).

Comparison with previous data (Perlman et al. 1994) reveals no evidence for superluminal motion. However, beaming is likely present within the core, since radio variability data from the UMRAO public archive yield

R. Ekers et al. (eds.), Extragalactic Radio Sources, 90–91.

$T_B > 3.6 \times 10^{13}$ K. An alternate explanation, gravitational lensing, is unlikely because we find no evidence for multiple images down to 2 mas.

The outer components of PKS 1413+135 are probably quasi-stationary 'minilobes', where the jets terminate. By assuming minimum-energy conditions and ram-pressure balance, we calculate $t \lesssim 7000 n^{0.5}$ years. Alternatively, it is unlikely that a source so small has been 'frustrated' by a dense ISM (e.g. Readhead et al. 1994).

It is likely that CSO, GPS (O'Dea et al. 1991) and CSS (Fanti et al. 1990) sources represent early stages in the lifetimes of powerful radio galaxies. Due to their larger size, the CSS sources may represent a later stage. This is corroborated by their lower turnover frequencies, implying that their jets propagate through a less dense medium. Jet ram pressure, combined with radiation pressure from the AGN, would likely thin the ISM with time.

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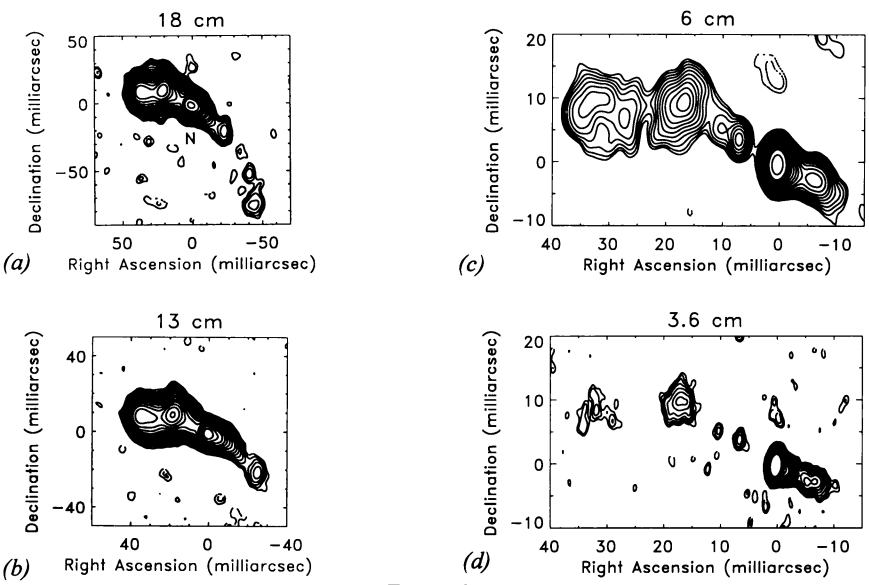

Figure 1.

https://doi.org/10.1017/S0074180900080141 Published online by Cambridge University Press