INTERSTELLAR SCATTERING AND THE EINSTEIN RING PKS 1830-211

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1. introduction

The remarkably strong radio gravitational lens PKS 1830-211 consists of a one arcsecond diameter Einstein ring with two bright compact components located on opposite sides of the ring. We have obtained high frequency (22 GHz) VLBA data on this sour-cc to determine the intrinsic angular sizes of the two compact components. Previous VLBI observations at lower frequencies indicate that the brightness temperatures of these components are significantly lower than 10^{10} K (Jauncey *et al.*, 1991), less than is typical for compact synchrotron radio sources. A possible explanation is that interstellar scattering (ISS) within our galaxy is broadening the apparent angular size of the source and thereby reducing the observed brightness temperature. This is plausible given the location of PKS **1830-211** only a few degrees away from the galactic center ($b = -5.7°$, $l = 12.2°$). The effects of ISS decrease rapidly with frequency, and should be very small at 22 GHz.

2. Observations

We observed PKS 1830-221 with the full VLBA at 22 GHz in May 1994. The data were correlated twice using phase centers corresponding to the locations of the two compact components, which we designate the northeast (NE) and southwest (SW) components. After calibration and fringe fitting in AIPS, we used the Caltech program Difmap for editing, self-calibration, imaging, and deconvolution. This paper presents our image of the SW component; imaging of the NE component is in progress.

3. Results

The two figures below show our VLBA image oft he SW component of PKS 183(1-21 1 and the deconvolved minor axis width of this component at three frequencies: 1.7 GHz (unpublished data from an ad-hoc VLBA experiment in 1990), 4.9 GHz (Jones, 1994), and 22 GHz (new data).

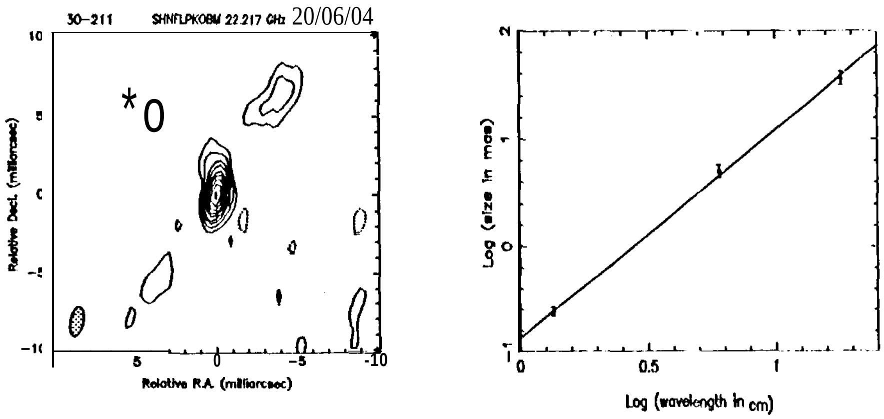

Figure 1. **LEFT:** The contours are -2, 2, 5, 10, 15, 25, .50, 70, and 95%, and the restoring beam FWHM is 1.9 x 0.8 mas with the major axis along position angle 11.5°. The absolute flux density scale is not yet fully calibrated, but this dots not affec t the measured angular size of the core. **RIGHT:** The deconvolved minor axis angular sizes and their (formal) errors determined with the AIPS program IMFIT, using only the upper 50% or less of the brightness range to avoid bias by any extended low-level structure.

The slope of the line fit to the angular size measurements is 1 .95 ± 0.14, consistent with the λ^2 dependence expected for scattering. This suggests that angular size measurements made by VLBI at frequencies $\lesssim$ 22 GHz are indeed affected by angular broadening due to ISS. At 22 GHz the size of the SW component core is 0.6 x 0.2 mas and $T_b \sim 10^{11}$ K.

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4. References

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