FLUX DENSITY VARIATIONS OF PKS 1830–211

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We have been observing the strong radio source and Einstein ring gravitational lens PKS 1830–211 as part of a flux density monitoring program at 2.3 and 8.4 GHz using the 26 m antenna at the Mt Pleasant Observatory. As can be seen from Figure 1 this source is variable at both frequencies. The 2.3 GHz flux density decreased from 10 Jy in 1990 November to a minimum of 9 Jy during 1992, and has since steadily increased to its present ~12 Jy. Over the same interval, the flux density at 8.4 GHz has exhibited greater variability, more than doubling from an initial value of 5 Jy in late 1990 to a peak of ~11 Jy early in 1992, before decreasing to a level of ~7.5 Jy. VLA observations by van Ommen et al. (1995) show that the 15 GHz total flux density increased before the 8.4 GHz brightening seen at Mount Pleasant. Although the 15 GHz time series is not well sampled, it is clear from these data that the 15 GHz outburst precedes the 8.4 GHz feature by ~400 days.

The radio morphology of PKS 1830–211 shows a steep spectrum ~1 arcsecond-diameter ring upon the opposite sides of which lie two bright compact components (Jauncey et al. 1991). To establish the spatial properties of the variability, we augmented the single-dish flux density measurements with high-resolution observations using the SHEVE VLBI array (Preston et al. 1993). Data obtained in 1990 July and 1992 March clearly show that the flux density variability is dominated by changes in the two compact components (King 1994). Northern Hemisphere VLBI observations (Jones et al. 1993) have demonstrated variability in the compact structure over the period coincident with the total power variability.

The single peak clearly visible in the 8.4 GHz light-curve indicates that the time delay between the two components is either less than the temporal

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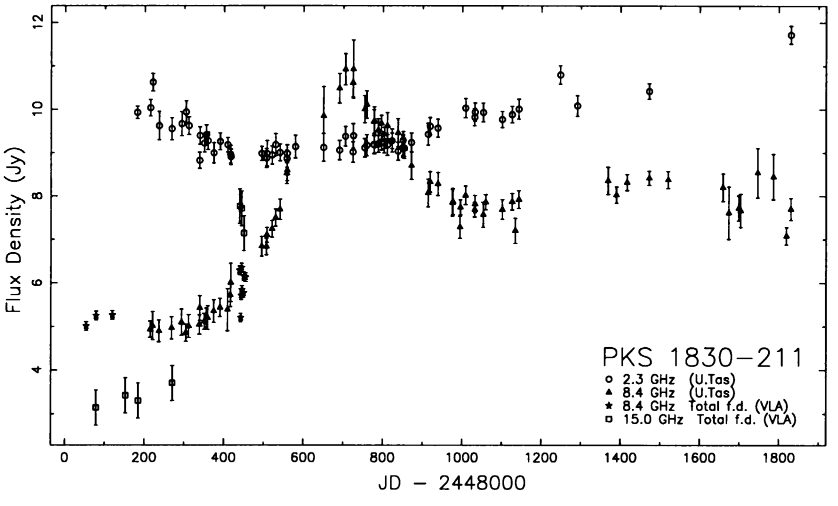

Figure 1. Complete 2.3 GHz and 8.4 GHz light-curves for PKS 1830–211 obtained with the Mt Pleasant 26 m antenna. VLA data from van Ommen et al. (1995) are also shown.

scale-size of the outburst, or very much greater than the time between outbursts. The high-resolution VLBI data show that the former is the case.

The confinement of variability to the compact components makes PKS 1830–211 an excellent target for relative time-delay studies. Such studies require frequent arcsecond-resolution observations. The steep spectrum of the ring structure means that the total flux density is dominated by the compact components at short wavelengths allowing straightforward modeling of the morphology.

We are about to begin a series of service observations with the Australia Telescope Compact Array over a period of approximately one year to monitor the relative intensities of the two compact components at 8.6 GHz as well as the total flux density at 4.8, 2.3 and 1.2 GHz. These observations are intended to provide a more direct and accurate measurement of the time delay as well as data on the propagation of outbursts as a function of wavelength.

References

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