IAU Colloquium 164: Radio Emission from Galactic and Extragalactic Compact Sources
ASP Conference Series, Vol. 144, 1998
J. A. Zensus, G. B. Taylor, & J. M. Wrobel (eds.)

PKS 1830–211: VLBA λ7mm Polarization Observations

M. A. Garrett & K. Leppänen
JIVE, Postbus 2, 7990 AA, Dwingeloo, The Netherlands

R. W. Porcas & A. R. Patnaik
Max-Planck Institute für Radioastronomie, Bonn, Germany

S. Nair
U. of Manchester, NRAL, Jodrell Bank, Macclesfield, Cheshire, U.K.

Harri Teräsranta
Metsahovi Radio Research Station, Kylmala, Finland

Abstract. We present λ7mm multi-epoch and polarization VLBA maps of the gravitational lens PKS 1830–211. The maps suggest that the radio structure of both images evolves rapidly. The offset between the polarized intensity and the total intensity may be used to constrain the magnification matrix.

1. Observations, Analysis, and Preliminary Results

We observed 1830–211 at λ7 mm (256 Mbits/sec) with the VLBA at three separate epochs: 31 May 1996, 14 July 1996 and 19 January 1997. The latter epoch was observed in dual polarization mode, and is the first of eight epochs observed using the VLBA over the first quarter of 1997. Hybrid maps of both 1830–211 NE and 1830–211 SW (see Fig. 1) were made simultaneously using a 0.4 sec integration time to avoid smearing. They show that the cm-VLBI cores have considerable sub-structure and that this evolves on comparatively short timescales—weeks, rather than the months or years usually associated with extra-galactic radio sources. Also note the similarity of the polarization angle in both images. We believe that these rapid structural changes may be explained if the lens magnifies each image such that the nominal sub-milliarcsecond resolution of these maps is boosted by a factor of 5-10 to the scale of a few tens of micro-arcsecond. The "similarity" between images observed at the same epoch also suggests that the time-delay may be shorter than previously reported (see Lovell et al., these Proceedings, p. 315).

The two brightest features in the NE and SW images, as well as the offset between the peak of polarized emission and total intensity, relate to each other with parities appropriate for lensed double images. A matrix constrained by these data makes some interesting "predictions" about the 15 GHz structure (see Porcas, these Proceedings, p. 303), transforming the hot-spot at the tip of the 15 GHz jet (as seen in the NE image) to within 2 mas of the SW core. However it also predicts a flux ratio of 0.25 (SW:NE) which is in poor agreement with the range observed by us (0.57–1.1) at λ7 mm. Variability on timescales shorter than the time delay may need to be taken into account.

Acknowledgments. The National Radio Astronomy Observatory is a facility of the National Science Foundation, operated under a cooperative agreement by Associated Universities, Inc.

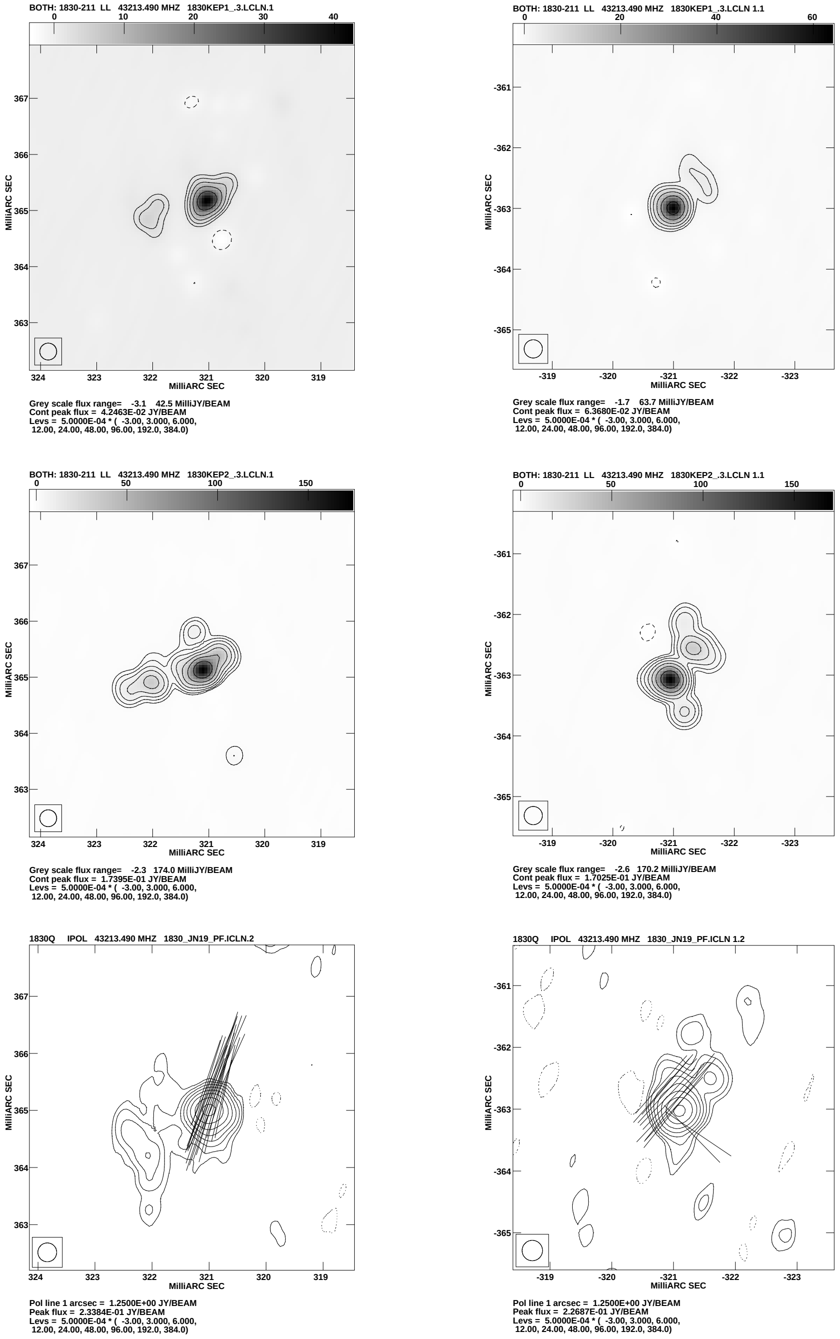

Figure 1. Multi-epoch 43 GHz VLBA maps of 1830–211 NE (left) and 1830–211 SW (right). The epoch of observation increases from top to bottom. Contours are spaced by factors of two in brightness, with the lowest at three times the rms noise (~ 0.5 mJy per beam) of the 19 Jan 1997 maps. The FWHM of the circular restoring beam is 0.33 mas.