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The Evolution of Extreme Scintillator: PKS B1144-379

N. M. M. Said, S. P. Ellingsen, S. S. Shabala, J. N. McCallum, H. E. Bignall, C. Reynolds

We have examined rapid variability in the radio flux density of the BL Lac object PKS B1144−379 observed at 6.5 GHz, with the University of Tasmania's Ceduna radio telescope. High-cadence monitoring of this extreme scintillator was carried out between 2003 and 2011. We have used structure functions created from the time series to determine the source characteristic timescale. The best-fitting annual cycle model for each year suggests that the scintillation pattern has an anisotropic structure. We find the annual cycle in the interstellar scintillation timescale only prominent for certain years where other evidence suggests that the core is compact.

The modulation index of the target source and its total mean flux density show an anticorrelation. From our measurements we calculate that the core angular size varies between 10-30 μas (0.08- 0.23 parsecs). The core component is found to be at its most compact size during two flares in the total flux density, which were observed in 2005 and 2008. The source angular sizes we determine are consistent with the compactness inferred from very long baseline interferometry (VLBI). We conclude that the long-term variability in the radio flux density of PKS B1144-379 are due to intrinsic variations and affect our ability to measure an annual cycle in its variability time scale. This long-term monitoring has significantly enhanced our understanding of the evolution of this extreme scintillator.

Key words: ISM: structure - quasars: galaxies - AGN