

Intraday Variability of Active Galactic Nuclei: present (Hobart & Ceduna radio telescopes) and future (LOFAR & SKA).

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In the centimeter regime, rapid flux density fluctuations with intraday time scales have been observed in a large fractions of flat spectrum radio sources and in few objects (ie. PKS 0405–385, J1819+385 and PKS 1257–326) extreme variations in amplitude up to 600% have been detected on time scales of less than one hour. The intraday variability (IDV) phenomenon is caused by a complex mixture of source-intrinsic and propagation effects. Clear evidence of the influence of the interstellar medium (ISM) is the observed seasonal modulation of the IDV. In fact, this is predicted by the interstellar scattering (ISS) theory if the orbital motion of the Earth and the velocity of the scattering screen are taken into account.

Such annual modulation provides information on the interstellar medium characteristics (i.e. velocity and distance of the scattering screen). Knowing the ISM properties, the micro-arc-second source structure can therefore be derived using the ISM as an interferometer with the Earth orbit synthesized aperture. The 30-m radio telescope in Ceduna has regularly measured the flux densities of several compact objects at 6.7 GHz over the past year to monitoring the annual cycle. Recently, a companion project has started using the 26-m antenna at Mt Pleasant (Hobart) at 8.4 and 2.2 GHz.

LOFAR will offer new opportunities for understanding the properties of the local ISM and should enable us to better determine information on the source from IDV observations.

The Ceduna observations have shown the importance of continuous monitoring of IDV source to properly characterise and to capture unexpected sudden changes in IDV properties. The multi-beaming nature of LOFAR and SKA will provide the ability to rapidly switch between sources all over the sky so as to monitor a large number of objects with a single LOFAR or SKA beam. This would enable Earth Orbit Synthesis analysis to be applied to a large number of sources.