Low Frequency Radio Variability, IDV, ISS; the changing paradigm

David L. Jauncey

Australia Telescope National Facility, CSIRO

In 1972, Hunstead presented strong evidence for large, fractional variations at 408 MHz on time-scales of a few months, in four sources. If intrinsic, such variability implied brightness temperatures well in excess of the $10^{12}$ K inverse-Compton limit. A decade later Rickett et al., speculated that such low frequency variability may be caused by scintillation in the ISM. At much the same time Heeschen discovered radio source flickering with time-scales of days to weeks, at 2.7 GHz, but was unable to distinguish unambiguously between intrinsic and extrinsic mechanisms. Precision flux density measurements at Effelsberg followed revealing large changes in the cm flux density of many flat-spectrum sources on time-scales of days, which they called intra-day variability (IDV), which initiated a vigorous debate as to their intrinsic or extrinsic origin. A decade later the discovery of the dramatic variability, on time-scales of less than an hour, in the southern quasar PKS0405−385 raised further questions, but also presented an opportunity to unambiguously address the question. Time-delay measurements in the pattern arrival times at widely spaced telescopes of this and other quasars, as well as the presence of an annual-cycle in the variability characteristics, have demonstrated clearly that inter-stellar scintillation (ISS) is the principal mechanism responsible for this IDV now widely seen at cm wavelengths.