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Multi-frequency blazar variability from decades to minutes

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The typical shape of blazar lightcurves' power spectra is a power-law, $P(f) = Af^{-\beta}$, where A is the normalization and β is the slope, indicating that the variability is generated by the underlying *stochastic* processes which is of colored noise type (i.e., $\beta \simeq 1 - 3$). Here we present the results of power spectral analysis of 5 blazars utilizing the *Fermi*-LAT survey at high energy $\gamma-$rays, *Swift*-XRT and *RXTE*-PCA data at X-rays, several ground based observatories and Kepler data at optical and single-dish radio telescopes operating at GHz frequencies (UMRAO and OVRO programmes). The novelty of our approach is that at optical regime, by combining long-term (historical optical light curves) and densely sampled intra-night lightcurves, the PSD characterisitics are investigated for temporal frequencies ranging over 7 orders of magnitude. Our analysis reveals that : (1) nature of processes generating flux variability at optical/radio frequencies is different from those at GeV freqeuncies ($\beta \sim 2$ and 1, respectively); this could imply, that $\gamma-$ray variability, unlike the Synchrotron (radio-to-optical) one, is generated by superposition of two stochastic processes with different relaxation timescales, (2) the main driver behind the optical variability is same on years, months, days, and hours timescales ($\beta \sim 2$), which argues against the scenario where different drivers behind the long-term flux changes and intra-night flux changes are considered, such as internal shocks due to the jet bulk velocity fluctuation (long-term flux changes) versus small-scale magnetic reconnection events taking place at the jet base (intra-night flux changes). Implications of these results are discussed in the context of blazar emission models.

Author: Dr GOYAL, Arti (Astronomical observatory of the Jagiellonian University)

Presenter: Dr GOYAL, Arti (Astronomical observatory of the Jagiellonian University)

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