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BlaVar: A numerical study of long-term multi-wavelength blazar variability

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Blazars are characterized by flux variability that is frequency-dependent and manifests in a variety of timescales. Decade-long monitoring of blazars at optical and infrared (OIR) wavelengths with the Small and Moderate Aperture Research Telescope System (SMARTS) in Chile and in gamma-rays with the Fermi Large Area Telescope (LAT) has enabled the systematic study of their multi-wavelength long-term variability. These studies pinpoint that besides extreme short-term variability (minutes to hours), a source can exhibit correlated and uncorrelated inter-band flux variability between different observation periods and/or on different timescales (days to years).

In this work, we investigate from a theoretical perspective the long-term variability properties of blazar emission. To do so, we impose variations on the main parameters of the one-zone leptonic model (injection luminosity of relativistic electrons, strength of magnetic field, Doppler factor, and external photon field luminosity) motivated by the Fermi-LAT full-mission light curves of blazars. Using as case studies two bright and well-monitored blazars from the SMARTS sample (PKS2155-304 and 3C273), we compute 10 year-long OIR, X-ray, and gamma-ray model light curves for different varying parameters. We compare the findings of our theoretical investigation with multi-wavelength observations using various measures of variability. While no single-varying parameter simulation can explain all multi-wavelength variability properties, our results motivate future time-dependent studies with coupling between two or more physical parameters to describe the multi-wavelength long-term blazar variability.

Keywords

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Collaboration

other Collaboration

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Theoretical Results

Primary author: POLKAS, Markos (National and Kapodistrian University of Athens)

Co-authors: PETROPOULOU, Maria Petropoulou (Princeton University); Dr VASILOPOULOS , Georgios (Yale University); Prof. MASTICHIADIS , Apostolos (National and Kapodistrian University of Athens); Prof. URRY, Megan (Yale University); Prof. COPPI, Paolo (Yale University); Prof. BAILYN, Charles (Yale University)

Presenter: POLKAS, Markos (National and Kapodistrian University of Athens)

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