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Exploring the variability properties of gamma-ray emission from blazars

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I present the results of variability study of a sample of 20 powerful blazars using Fermi/LAT (0.1-300 GeV) observations. We studied decade-long observations applying various analysis tools such as flux distribution, symmetry analysis, and RMS-flux relation. It was found that the γ-ray flux distribution closely resembles a log-normal probability distribution function and can be characterized by linear RMS-flux relation. The power spectral density analysis shows the statistical variability properties of the sources as studied are consistent with flicker noise, an indication of long-memory processes at work. Statistical analysis of the distribution of flux rise and decay rates in the light curves of the sources, aimed at distinguishing between particle acceleration and energy-dissipation timescales, counterintuitively suggests that both kinds of rates follow a similar distribution and the derived mean variability timescales are on the order of a few weeks. The corresponding emission region size is used to constrain the location of γ-ray production sites in the sources to be a few parsecs. Additionally, using Lomb-Scargle periodogram and weighted wavelet z-transform methods and extensive Monte Carlo simulations, we detected year-timescale quasi-periodic oscillations in the sources S5 0716+714, Mrk 421, ON +325, PKS 1424-418, and PKS 2155-304. We also performed recurrence quantification analysis of the sources and directly measure the deterministic quantities, which suggest that the dynamical processes in blazars could be a combination of deterministic and stochastic processes, while some of the source light curves revealed significant deterministic content.

Keywords

AGN, blazars, gamma-ray emission, relativistic jets, non-thermal emission, particle acceleration, time series analysis

Collaboration

other Collaboration

Subcategory

Experimental Results

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