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Correlations between X-ray spectral parameters of Mkn 421 using long-term Swift-XRT data

We have performed a detailed analysis of the X-ray spectra of the blazar Mkn 421 using Swift-XRT observations taken between 2005 and 2020, to quantify the correlations between spectral parameters for different models. In an earlier work, it has been shown that such spectral parameter correlations obtained from a single short flare of duration ~ 5-days of Mkn 421, can be used to distinguish spectrally degenerate models and provide estimates of physical quantities. In this work, we show that the results from the long-term spectral parameter correlations are consistent with those obtained from the single flare. In particular, that the observed spectral curvature is due to maximum cutoff energy in the particle distribution is ruled out. Instead, models where the curvature is due to the energy dependence of escape or acceleration timescale of the particles are favored. The estimated values of the physical parameters for these models are similar to the ones obtained from the single flare analysis and are somewhat incompatible with the physical assumption of the models, suggesting that more complex physical models are required. The consistency of the results obtained from the long and short-term evolution of the source, underlines the reliability of the technique to use spectral parameter correlations to distinguish physical models.

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