

Test Periodic Signals in Red-Noise Time Series of Active Galactic Nuclei

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I will talk about our recent work on testing periodic signals in active galactic nuclei (AGNs). It is known that AGNs show random brightness variability at all wavebands with a broad power spectrum, usually characterized by a red-noise shape. Such random nature of variations can lead to spurious few-cycle periodicities in AGN time series, greatly complicating period searches in time-domain surveys with limited baselines. Based on our previously developed framework that models AGN time series in frequency domain, we propose a forward Bayesian approach for testing periodic signals by describing a time series as a sum of a red-noise stochastic process and a deterministic periodic process. The narrow spectral peak in periodograms caused by the periodic process is parameterized to be a Gaussian. A Markov chain Monte-Carlo technique is employed to explore posterior distributions of the parameters and perform model comparison between the periodic and purely random descriptions. The new approach is in particular adapted for irregularly sampled time series with few period cycles. Application of our testing procedure to PG1302-120, NGC 5548 and Ark 120 are presented.