Preliminary test on the ACF

When we use the Autocorrelation Function (ACF) for searching QPO signals in AGN data, it is important to note that the pure Power Spectral Density function, hence to determine the underlying QPO signals we will test some of the commonly-used statistical methods: wavelets, time-domain Bayesian fitting (CARMBA), epoch folding, and autocorrelation functions.

For each function, we will perform Monte Carlo simulations and empirically test a range of red noise continuum “background” shapes and a range of QPO strengths. We will also test a range of sampling patterns to assess the impact of data gaps inherent in realistic light curve sampling. For large surveys, we can create mock data sets assuming different distributions in AGN mass and luminosity, and thus PSD red noise parameters; we can then gauge false alarm probabilities across entire samples. We will discuss the limitations and the range in detection sensitivity between the various methods for the various forms of the red noise background and (deterministic) characteristic signals in AGN light curves when red noise is present.

Work plans on Wavelets

Wavelets are used as an tool for searching for periodic signals, with applications found across physics and mathematics, e.g., Wavelet transforms and their applications to turbulence (Farge 1992), climate science (Torrence & Compo 1998).

However, in many cases, one searches for signals relative to a white noise/poissonian background. Application to different red noise backgrounds (as appropriate for AGN) is not yet thoroughly explored.

Our plan is to map out how to use the wavelet tool to quantify (narrow-band) strictly-periodic signals in AGN light curves when red noise is present, and will help the community produce only statistically-significant period claims in the literature.

Further Directions/Acknowledgements

We will adopt the algorithm of Emmaoulopoulos et al. (2013) for more complex (i.e., log-linear) flux distributions of light curves. Our work will apply to both individual light curves and database trawls, and will help the community produce only statistically-significant period claims in the literature.

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