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Statistical Characterization of Flux Variability in X-ray Binaries

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X-ray binaries provide a powerful framework for studying accretion processes and compact objects such as neutron stars and black holes. Their flux variability, spanning time scales from milliseconds to years, reflects the complex interplay of mass transfer, disk instabilities, and emission mechanisms. We present a statistical characterization of flux variability using probability distribution functions. We demonstrated that statistical characterization serves as a reliable indicator of additive versus multiplicative processes and reveals differences between neutron star and black hole systems. As a future direction, we propose applying machine learning methods to classify variability patterns across large datasets, enabling automated mapping between statistical signatures and accretion states. This study highlights the importance of advanced statistical tools, coupled with data-driven techniques, in uncovering the physical processes driving variability in X-ray binaries.

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