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Timing and Spectral Variability in Black Holes

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The light curves of black hole X-ray binaries show variability on timescales from milliseconds to months. The variability is from X-ray-bright matter in the inner region of curved spacetime surrounding the black hole. We use Fourier techniques to identify timing signals such as quasi-periodic oscillations (QPOs) and intrinsic broadband/band-limited noise. These signals are not just due to overall variations in brightness, but variations in and interactions between spectral components. This burgeoning field of X-ray spectral-timing has seen a surge in developments of analysis techniques that measure rapid time-dependent spectral changes. In this talk I will review timing and spectral-timing techniques as applied to stellar-mass black hole observations, physical insights gained from this analysis, current and upcoming spectral-timing observatories, and the multi-wavelength future of (spectral-)timing.

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