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Measuring the magnetic dipole moment and magnetospheric fluctuations of SXP 18.3 with a Kalman filter

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X-ray flux and pulse period fluctuations of accretion-powered pulsars in the Small Magellanic Cloud and elsewhere convey important information about the disk-magnetosphere interaction. In this talk, we present a novel signal processing framework based on the canonical magnetocentrifugal accretion torque and a linear Kalman filter to generate time-dependent estimates of the state variables associated with magnetocentrifugal accretion, namely the mass accretion rate, the Maxwell stress at the disk-magnetosphere boundary, and the radiative efficiency of the accretion. The parameter estimation scheme maximizes the Kalman filter likelihood to infer the underlying static physical parameters, including the magnetic dipole moment μ. We present new results for the Small Magellanic Cloud X-ray transient SXP 18.3 and discuss implications of the parameter estimation platform for (i) a population-wide analysis of magnetic dipole moments μ in the Small Magellanic Cloud; and (ii) searches for continuous gravitational radiation from low-mass X-ray binaries.

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