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High-frequency noise in GRO J1744–28: Evidence for a radiation-pressure dominated accretion disk

Neutron stars accreting matter via an accretion disk offer a unique way to examine the interaction of radiation and matter under extreme conditions. If the neutron star has an ultra-strong magnetic field, the disk is truncated at the so-called magnetospheric radius and matter is guided onto the neutron star surface where its energy is released in X-rays (so-called X-ray pulsars). The properties of the fast flux variability carry an imprint of the geometrical and physical conditions of the system.

In the current work we examined the low-mass X-ray pulsar GRO J1744−28 which is the only source showing both regular pulsations and type-II X-ray bursts. The source is accreting via an accretion disk, whose inner regions are expected to become radiation-pressure dominated during observed super-Eddington outbursts. We traced the evolution of its power spectra with luminosity during the outbursts and report the discovery of the high-frequency break which can be ascribed to the inner radius of the accretion disk. We find that the dependence of the inner radius on the luminosity differs from the standard relation for the gas-pressure dominated disk. Following the perturbation propagation model, we were able to create a model for the power spectra generated in an accretion disk with a radiation-pressure dominated inner region. The proposed model demonstrates a strong qualitative match with the observations.

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