

The impact of neutron star spin on X-ray spectra

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Abstract

© 2016 The Authors. We investigate whether the intrinsic spin of neutron stars (NSs) leaves an observable imprint on the spectral properties of X-ray binaries. To evaluate this, we consider a sample of nine NSs for which the spins have been measured that are not accreting pulsars (for which the accretion geometry will be different). For each source, we perform spectroscopy on a majority of RXTE hard-state observations. Our sample of sources and observations spans the range of the Eddington ratios $LX/LEdd \sim 0.005-0.100$. We find a clear trend between the key Comptonization properties and the NS spin for a given accretion rate. Specifically, at a given $L/LEdd$, for more rapidly rotating NSs we find lower seed photon temperatures and a general increase in Comptonization strength, as parametrized by the Comptonization y parameter and amplification factor A . This is in good agreement with the theoretical scenario whereby less energy is liberated in a boundary layer for more rapidly spinning NSs, resulting in a lower seed photon luminosity and, consequently, less Compton cooling in the corona. This effect in extremis results in the hard states of the most rapidly spinning sources encroaching upon the regime of Comptonization properties occupied by black holes.

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Keywords

Accretion, Accretion discs, Stars: neutron, X-rays: binaries, X-rays: general

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