

XMM-Newton and NuSTAR observations of the redback millisecond pulsar PSR J2215+5135

We present a follow-up X-ray study of the redback millisecond pulsar PSR J2215+5135. PSR J2215+5135 was discovered as a radio pulsar with an orbital period of 0.17 day. It is in a compact binary system with a low-mass companion of $0.33 M_{\odot}$ (Linares, et al., 2018).

Observationally, redback systems occasionally exhibit a double-peaked structure in their X-ray light curves. This phenomenon could be explained by an intra-binary shock with Doppler boosting (Sullivan & Romani, 2024). The intra-binary shock arises from the interaction between the pulsar wind and stellar wind from the companion (Takata, et al., 2012).

We analyze the latest *NuSTAR* observations of PSR J2215+5135 in 2024 in the 3-79 keV band, along with the older *XMM-Newton* observations between 2016 and 2022 in the 0.2-10 keV band. Our timing analysis confirmed the existence of a double-peaked profile in both *XMM-Newton* and *NuSTAR* light curves. X-ray emission up to about 40 keV is detected, and the joint spectrum can be modeled with a power-law plus a neutron star atmosphere model. At a distance of 3 kpc, the 0.2-79 keV luminosity is $1.03 \times 10^{33} \text{ erg s}^{-1}$. A spectral change has also been observed in the phase-resolved spectrum, indicating variability in the shock region.

Keywords: binaries: close, pulsars: individual (PSR J2215+5135), X-rays: binaries

References:

- Linares, M., Shahbaz, T., & Casares, J. 2018, APJ, 859, 54
Takata, J., Cheng, K. S., & Taam, R. E. 2012, APJ 745, 100
Sullivan, A. G., & Romani, R. W. 2024, APJ, 974, 315

Section

High Energy

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