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PPANDA: Pulse Profiles of Accreting Neutron Stars Deeply Analyzed: the LMXB 4U 1626-67

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The spectral modelling of accreting X-ray pulsars is difficult owing to the anisotropy linked to the strong magnetic field and the geometrical properties such as the inclination of the line of sight and the location of the magnetic poles. This strongly influences the observed phase variability at the spin frequency. In Ferrigno et al. (2023), we introduced a method to compute pulsed profiles with the intrinsic energy resolution of the NuSTAR instruments optimized for the S/N, enabling detailed analysis of the Pulsed Fraction across different energy bands—referred to as the Pulsed Fraction Spectrum (PFS). This approach revealed characteristic features in the PFS corresponding to well-known spectral signatures, such as the iron fluorescence line and cyclotron resonance scattering features (CRSFs), superimposed on an overall increasing trend of pulsed fraction with energy.
Furthermore, a detailed analysis of the pulse profiles themselves—such as cross-correlation studies and phase lags—provides complementary insights that contribute to a more complete understanding of their energy dependency.
In this talk, I will give an overview of our method and focus on the results of its application to the Low Mass X-ray Binary (LMXB) 4U 1626-67, which exhibits a CRSF at $\approx$ 38 keV in the phase averaged spectrum. We found evidence for the CRSF in the PFS, phase lags and cross-correlation, but no signatures of the iron line, which is present in the energy spectra.
Our method paves the way for systematic searches for CRSFs and other spectral features, providing additional information to be considered in spectral modelling.

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