

Contribution ID: 25

Type: **Oral**

Two Possible Optical–X-Ray Anti-Correlations of PSR J1023+0038

Saturday, May 17, 2025 2:30 PM (15 minutes)

Using 18 X-ray/B-band simultaneous XMM-Newton observations (717 ks in total) of PSR J1023+0038 taken during the low-mass X-ray binary (LMXB) state, we find a general trend that the amplitude of the B-band orbital modulation was lower when the observed X-ray flux was higher. Depending on the analysis method adopted, the statistical significance of the anti-correlation can be from 1.3σ to 3.1σ . This result challenges the general belief that the X-ray emission is one of the major heating sources for the optical modulation in redback pulsar binaries. We also extended the analysis to the GeV γ -ray band using the Fermi-LAT data, but the result is insignificant to claim any relations. Moreover, another X-ray/optical correlation regarding the low modes of the system was found in some of the XMM-Newton observations, and the astrophysical reason behind is currently unclear yet. These possible anti-correlations likely support that the irradiation is generally stronger when the X-ray flux is in a fainter state, indicating that there is a more dominant irradiation source than the X-ray emission.

Section

High Energy

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Session Classification: High-energy astrophysics