



Contribution ID: 45

Type: **Poster**

## **Spectro-temporal Investigation of Quasi-periodic Oscillations From Black Hole X-ray Binary 4U 1630-472 Using NICER**

We present a comprehensive analysis of the spectro-temporal characteristics of the X-ray variabilities from black hole X-ray binary 4U1630–472 during its three outbursts (2018, 2020, and 2021) as observed by *NICER*. We detected 27 Quasi-Periodic Oscillations (QPOs), out of which 25 were observed during the 2021 outburst. In this study, we specifically focus on the relationship between spectral and timing parameters and the frequency of type-C QPOs in the 2021 outburst of the black hole binary 4U 1630–472 during its rising phase. We found strong correlations between the photon index of the non-thermal emission and the QPO frequency. We also observed a critical frequency at  $\sim 2.31$  Hz, above which the behavior of the Q-factor of the QPO changed significantly with the QPO frequency. We further identified two events characterized by a surge in the total flux, corresponding to the disappearance of type-C QPOs. Although the first event appeared like an X-ray flare, during the second event, the source reached a state with a total flux higher than  $10^{-8}$  erg/cm<sup>2</sup>/s and exhibited a different type of QPO with lower frequencies and weaker amplitudes. We compare our results with the previously reported QPO characteristics for black hole outbursts and discuss the various models that could interpret the critical frequency and potentially explain the origin and evolution of these type-C QPOs.

### **Collaboration(s)**

**Author:** CHOPRA, Ansh (Gran Sasso Science Institute)

**Co-authors:** Dr CHAKRABORTY, Manoneeta (Indian Institute of Technology Indore); Dr KASHYAP, Unnati (Texas Tech University)

**Presenter:** CHOPRA, Ansh (Gran Sasso Science Institute)

**Session Classification:** PO-2

**Track Classification:** Gamma-Ray Astrophysics