Contribution ID: **65** Type: **Poster**

Flares from stars crossing active galactic nuclei disks on low-inclination orbits

Friday, 15 December 2023 15:44 (1 minute)

The origin of the recently discovered new class of transients, X-ray quasi-periodic eruptions (QPEs), remains a puzzle. Due to their periodicity and association with tidal disruption events and active galactic nuclei (AGN), it is natural to relate these eruptions to stars or compact objects in tight orbits around supermassive black holes. In our work, we predict the properties of emission from bow shocks produced by stars crossing AGN disks and compare them to the observed properties of QPEs. We find that when a star's orbit is retrograde and has a low inclination with respect to the AGN disk and the star is massive, the breakout emission from the bow shock can explain the observed duration and X-ray luminosity of QPEs. This model can further explain various observed features of QPEs, such as their complex luminosity evolution, the modulation of the luminosity and the period, the evolution of the hardness ratio, and the preference of the central SMBHs to have low masses. I will further discuss the formation scenario of tight stellar orbits and advantages of our model against others.

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Session Classification: Poster