Contribution ID: **2** Type: **Talk**

The Transient Slim Disk of the Changing-look Active Galactic Nucleus 1ES 1927+654

Sunday 25 June 2023 16:54 (18 minutes)

In changing-look AGNs, the optical-to-X-ray continuum flux typically increases significantly as broad emission lines appear. The changing-look AGN 1ES 1927+654, hosting already a highly accreting black hole, displays peculiar X-ray properties after its optical changing-look event in early 2018. We carried out a follow-up campaign to probe its extreme accretion physics, using 34 optical spectra, 800 NICER and 14 Swift/XRT observations, as well as 7 simultaneous XMM-Newton/NuSTAR exposures. Detailed spectral energy distribution analysis suggests that the black hole was accreting super-critically, with $t^{-5/3}$ declining mass accretion rate. The bolometric luminosity was logarithmically dependent on the mass accretion rate, suggesting the existence of a slim disk. After $0.55M_{\odot}$ of material was consumed, the evolution of the radiation efficiency and disk temperature suggests that the accretion flow finally returned to a thin disk. The mass budget yields the radius of the most bound orbit, which is consistent with the broad-line region orbit, favoring a tidal disruption event as the origin of the outburst. During the transient slim disk phase, the X-ray corona tightly correlated with the properties of the inner accretion flow, suggesting that the corona plasma originated from the disk itself. Additionally, the UV-X-ray spectral index and bolometric correction follow a completely different branch during the slim disk phase. We model the X-ray variability with a Gaussian process, finding that the correlation timescale is tightly correlated with disk properties. This study provides several important insights into the physical properties of slim disks and the AGN unified model.

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Session Classification: Nuclear transients: TDEs, QPEs, and Changing-look AGNs