S25a Tracing the fading phase of active galactic nuclei in $z < 0.4$ using eROSITA, WISE, and SDSS

Samip Gauchan, Kohei Ichikawa (Waseda University)

Active galactic nuclei (AGN) are vital for exploring the episodic nature of supermassive black hole (SMBH) growth. A distinct AGN population, termed "fading AGN", shows strong past activity on kiloparsec (∼1 kpc) scales traced by narrow-line region (NLR) emission, but exhibits much weaker activity on small scales (< 10 pc) traced by either X-ray or mid-infrared (MIR) dust emission, suggesting a decline in AGN luminosity for the last 10^{3-4} yr. Pflugradt et al. (2022) cross-matched the SDSS type-1 AGN catalog at $z < 0.4$ with the WISE MIR catalog, and identified 50 fading AGN candidates out of ∼9000 sources that started its luminosity decline $\sim 10^{3-4}$ years ago. In this study, using eROSITA X-ray data, we search for a consistent decrease in luminosity across the NLR, torus, and X-ray corona, indicating that their luminosity decline began $\sim 10^{3-4}$ years ago and has persisted into the past decade. Among ∼10,000 sources, we identify ∼60 candidates, with bolometric luminosities derived from WISE MIR data at least an order of magnitude lower than those inferred from [OIII] NLR emission. Notably, four of these candidates exhibit a consistent decline from the NLR, torus, and to X-ray based AGN luminosities. These sources show Eddington ratios of $L_{\rm bol,[OIII]}/L_{\rm Edd} \sim 1$ in the NLR while $L_{\rm bol,X}/L_{\rm Edd} \sim 0.01$ in the X-ray, reflecting a continuous fading of accretion power. This requires a certain path producing drastic AGN luminosity declining for over two orders of magnitude within a short timescale of 10^{3-4} yr, which is slightly shorter than the typical inflow timescale.