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Observational constraints on the dependence of the stochastic X-ray flux variations on black hole mass and Eddington ratio

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The radiation produced by the accretion of matter onto supermassive black holes exhibits stochastic flux variations across a range of timescales. These fluctuations offer critical insights into the geometry and physical conditions of the accretion flow as well as the interplay between the different energy emitting regions. In this presentation I will focus on the X-ray flux variability of AGN and its dependence on the physical parameters of the active black hole, such as mass and Eddington ratio. Instead of studying individual sources, I will highlight the power of ensemble variability studies, leveraging large samples to uncover average trends. Multi-epoch eROSITA All Sky Survey data and archival XMM observations of tens of thousands of SDSS QSOs are used to characterise the ensemble X-ray variability in bins of black hole mass and Eddington ratio. The analysis employs new Bayesian methods that correctly account for the Poisson nature of X-ray observations and allow maximal information extraction from the multi-epoch observations. The results include evidence of an anti-correlation between X-ray variability and black hole mass or Eddington ratio, but also an intriguing reversal of this trend for the fastest accreting black holes. These results will be discussed in the context of different physical models for the feeding and feedback cycle of the accreting supermassive black holes.

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