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# **X-RAY POPULATION STUDIES WITH eROSITA: FROM SUPERMASSIVE BLACK HOLES TO THE CIRCUMGALACTIC MEDIUM**

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eROSITA has sharpened and deepened our view of the X-ray sky, far outshining its 30-year-old predecessor, ROSAT. The enhanced sensitivity and spatial resolution allow us to probe much fainter objects, be they point sources or extended. I show two powerful applications using the eROSITA Final Equatorial Depth Survey (eFEDS), a test patch designed to achieve in 3 months a depth that the all-sky survey will only attain in 4 years. First, by stacking ~2000 galaxies optically selected from the Sloan Digital Sky Survey, I measure the X-ray surface brightness profiles of the circumgalactic medium (CGM) as a function of stellar mass and star-formation rate. I compare these to mock eROSITA observations of galaxies from the IllustrisTNG and EAGLE simulations, and show how the discrepancies can guide us towards improved models of galactic feedback. Second, I cross-correlate >12,000 galaxies at  $z < 0.15$  from the SDSS and GAMA surveys with the eFEDS point sources, thereby associating active galactic nuclei (AGN) with host galaxies. Then, I run a Bayesian inference pipeline (following Miller+ 2015, Kelly+2007) to infer the supermassive black hole (SMBH) occupation fraction as a function of stellar mass. Lastly, I compare the measured SMBH occupation fractions to semi-analytic models from Ricarte & Natarajan 2018, showing that while SMBH seed models are currently indistinguishable, the present-day occupation fraction strongly constrains possible growth channels for the seeds. Both these studies will be expanded greatly with the upcoming release of the all-sky eRASS1.