

Hunting ULX candidates in eROSITA all sky survey

The research project is offered by PI G. Vasilopoulos in collaboration with Prof. P. Petropoulou. The project can be a part of an undergraduate research project with a duration of about 2 months. Interested parties can contact the PI via email as soon as possible and preferably before Feb 27th, applications will be evaluated in the order they are received until a suitable candidate is found.

1 Research project

Our understanding of ultraluminous X-ray sources (ULXs) – off-nuclear X-ray sources with luminosities in excess of 10^{39} erg/s – has evolved significantly over the past few years. The eROSITA telescope array aboard the Spektrum Roentgen Gamma (SRG) satellite began surveying the sky in December 2019, with the aim of producing all-sky X-ray source lists and sky maps of an unprecedented depth. In January 2024, eROSITA released its first point source catalog (about 1 million sources) covering the western Galactic hemisphere. The goal of this project is to identify X-ray sources that are associated within nearby galaxies (i.e. lie within the optical ellipse of a known galaxy). This would enable to derive X-ray luminosities from the host galaxy distances and establish a census of ULXs based on eROSITA observations. Part of the project would require crossmatching different catalogues and creation of finding charts to visually confirm the findings. For the Most intriguing newly discovered ULXs further monitoring data are going to be requested from other X-ray telescopes like *Swift*/XRT through time of opportunity observations. The requested data are expected to become available within the duration of the project and the student will get the opportunity to analyze the as well as prepare the requested observations.

Requirements, skills, qualifications:

1. Creativeness, motivation, and independence are especially welcome.
2. Experience with astrophysics, statistics and relativity problems is appreciated.
3. Some programming experience (e.g. Python) is mandatory.
4. Proficiency in English.

Literature:

- [1] The Heraklion Extragalactic Catalogue (HECATE), with information for 200K galaxies within about 200 Mpc. <https://hecate.ia.forth.gr/>
- [2] The SRG/eROSITA all-sky survey: First X-ray catalogues and data release of the western Galactic hemisphere. Catalog provides a list of about 1 million sources and 5K hard X-ray sources. https://erosita.mpe.mpg.de/dr1/AllSkySurveyData_dr1/Catalogues_dr1/
- [3] A multimission catalogue of ultraluminous X-ray source (ULX) candidates.

References

- [1] Kowlakas K. et al., 2021, MNRAS, 506, 1896
- [2] Merloni A. et al., 2024, arXiv e-prints, arXiv:2401.17274
- [3] Walton D. J. et al., 2022, MNRAS, 509, 1587

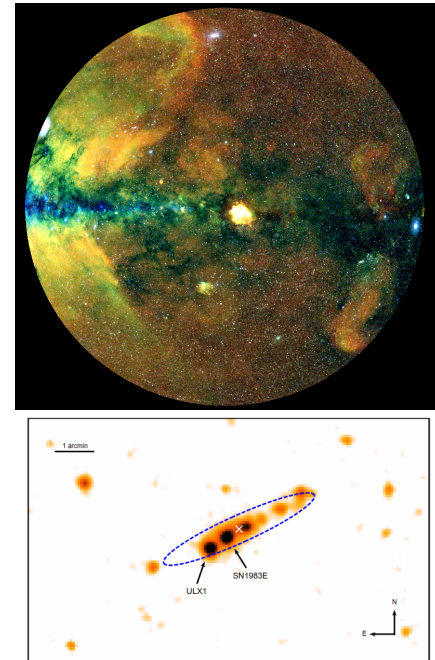


Figure 1: **Top:** RGB eROSITA-DE X-ray image of eRASS1 with a Zenith Equal Area projection. Red, green, and blue colours represent X-ray intensities in the 0.3–0.6, 0.6–1.0, and 1.0–2.3 keV energy bands, respectively. **Bottom:** ULX candidate within D25 ellipse of NGC 3044 based on XMM-Newton data.