Missing links of neutron star evolution in the eROSITA sky

A. M. Pires[1*], A. D. Schwope[1], C. Motch[2]

[1]Leibniz-Institut für Astrophysik Potsdam (AIP), Germany

[2]Observatoire Astronomique, Strasbourg, France

Since the discovery of the first radio pulsar fifty years ago, the population of neutron stars in our Galaxy has grown to over 2500, of which a handful is exclusively seen in X-rays. Despite their scarcity, these objects are key to understanding evolutionary aspects that are neither predicted by theory, nor probed by the normal pulsar population. In particular, scenarios involving magnetic field decay [1, 2] and field burial by fallback accretion after the supernova explosion [e.g. 3–5] are worth noting, as they are expected to significantly alter the star's rotational and thermal evolution and, hence, visibility across the electromagnetic spectrum. The forthcoming all-sky X-ray survey of eROSITA is therefore timely for a better sampling of neutron stars that are especially silent in the radio and gamma-ray regimes.

To estimate the number of isolated neutron stars to be detected in the eROSITA all-sky survey through their thermal X-ray emission, we performed Monte Carlo simulations of a population synthesis model [7]. Our study indicates an expected number of up to 100 well-detected thermally emitting neutron stars to be found after four years. The selection of newly proposed neutron star candidates among the myriad of eROSITA-detected sources will be challenging and will require synergy with multiwavelength surveys. Although optical follow-up will require very deep observations – in particular, the identification of most of the faintest candidates will have to wait for the next generation of extremely large telescopes – sources at intermediate fluxes can be selected for follow-up investigations using current facilities. Beyond the discovery of new sources and long-sought evolutionary missing links, the eROSITA survey has therefore the unique potential to unveil the faint X-ray end of the neutron star population.

References

[1] J. A. Pons, J. A. Miralles, & U. Geppert (2009). A&A, 496, 207

[2] D. Viganò, N. Rea, J. A. Pons, et al. (2013). MNRAS, 434, 123

[3] R. A. Chevalier (1989). ApJ, 346, 847

[4] U. Geppert, D. Page & T. Zannias (1999). A&A, 345, 847

[5] W. C. G. Ho (2011). MNRAS, 414, 2567

[6] P. Predehl (2014). AN, 335, 517

[7] A. M. Pires, A. D. Schwope, & C. Motch (2017). AN; in press. DOI: 10.1002/asna.201713333

*E-mail: apires@aip.de