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eROSITA Science Book: Mapping the Structure of the Energetic Universe

[A. Merloni](#), [P. Predehl](#), [W. Becker](#), [H. Böhringer](#), [T. Boller](#), [H. Brunner](#), [M. Brusa](#), [K. Dennerl](#), [M. Freyberg](#), [P. Friedrich](#), [A. Georgakakis](#), [F. Haberl](#), [G. Hasinger](#), [N. Meidinger](#), [J. Mohr](#), [K. Nandra](#), [A. Rau](#), [T.H. Reiprich](#), [J. Robrade](#), [M. Salvato](#), [A. Santangelo](#), [M. Sasaki](#), [A. Schwobe](#), [J. Wilms](#), the [German eROSITA Consortium](#)

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eROSITA is the primary instrument on the Russian SRG mission. In the first four years of scientific operation after its launch, foreseen for 2014, it will perform a deep survey of the entire X-ray sky. In the soft X-ray band (0.5-2 keV), this will be about 20 times more sensitive than the ROSAT all sky survey, while in the hard band (2-10 keV) it will provide the first ever true imaging survey of the sky at those energies. Such a sensitive all-sky survey will revolutionize our view of the high-energy sky, and calls for

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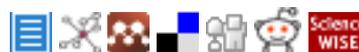
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major efforts in synergic, multi-wavelength wide area surveys in order to fully exploit the scientific potential of the X-ray data. The design-driving science of eROSITA is the detection of very large samples ($\sim 10^5$ objects) of galaxy clusters out to redshifts $z > 1$, in order to study the large scale structure in the Universe, test and characterize cosmological models including Dark Energy. eROSITA is also expected to yield a sample of around 3 millions Active Galactic Nuclei, including both obscured and un-obscured objects, providing a unique view of the evolution of supermassive black holes within the emerging cosmic structure. The survey will also provide new insights into a wide range of astrophysical phenomena, including accreting binaries, active stars and diffuse emission within the Galaxy, as well as solar system bodies that emit X-rays via the charge exchange process. Finally, such a deep imaging survey at high spectral resolution, with its scanning strategy sensitive to a range of variability timescales from tens of seconds to years, will undoubtedly open up a vast discovery space for the study of rare, unpredicted, or unpredictable high-energy astrophysical phenomena. In this living document we present a comprehensive description of the main scientific goals of the mission, with strong emphasis on the early survey phases.

Comments: 84 Pages, 52 Figures. Published online as MPE document. Edited by S. Allen. G. Hasinger and K. Nandra. Few minor corrections (typos) and updated references

Subjects: **High Energy Astrophysical Phenomena** (**astro-ph.HE**); Cosmology and Nongalactic Astrophysics (astro-ph.CO)

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