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# Global X-ray Imaging of the Earth's Magnetosphere

G. Branduardi-Raymont and the AXIOM Team
University College London, Mullard Space Science Laboratory, Dorking, UK (gbr@mssl.ucl.ac.uk)

Plasma and magnetic field environments can be studied in situ, or by remote sensing. In situ measurements return precise information about plasma composition, instabilities and dynamics, but cannot provide the global view necessary to understand the overall behaviour and evolution of the plasma, which instead can be explored by remote imaging.

We propose a new approach by remote global X-ray imaging, now possible thanks to the relatively recent discovery of solar wind charge-exchange X-ray emission; this has been found, by observatories such as XMM-Newton, to occur in the vicinity of the Earth's magnetosphere and to peak in the sub-solar magnetosheath, where both solar wind and neutral exospheric densities are high.

We describe how an appropriately designed and located X-ray telescope, supported by simultaneous in situ measurements of the solar wind, can be used to image the Earth's dayside magnetosphere, magnetosheath and bow shock, with temporal and spatial resolutions sufficient to address key outstanding questions concerning how the solar wind interacts with planetary magnetospheres. This medium-size mission incorporates a wide-field soft X-ray telescope, using micropore optics and CCD detectors, for imaging and spectroscopy, a proton and alpha particle sensor designed to measure the bulk properties of the solar wind, an ion composition analyser which aims to characterise the populations of minor ions in the solar wind, and a magnetometer for accurate measurements of the strength and direction of the magnetic field. Details of the mission profile will be presented, as well as simulations of the expected performance for possible mission configurations.

The AXIOM Team: G. Branduardi-Raymont(1), S. F. Sembay(2), J. P. Eastwood(3), D. G. Sibeck(4), A. Abbey(2), P. Brown(3), J. A. Carter(2), C. M. Carr(3), C. Forsyth(1), D. Kataria(1), S. Milan(2), C. J. Owen(1), A. M. Read(2), C. S. Arridge(1), A. J. Coates(1), M. R. Collier(4), S. W. H. Cowley(2), G. Fraser(2), G. H. Jones(1), R. Lallement(5), M. Lester(2), M. Palmroth(6), F. S. Porter(4), T. Yeoman(2)

1 University College London, Mullard Space Science Laboratory (UK)
2 University of Leicester, Department of Physics and Astronomy (UK)
3 Imperial College London (UK)
4 NASA Goddard Space Flight Center (USA)
5 LATMOS/Institute Pierre Simon Laplace (France)
6 Finnish Meteorological Institute (Finland)