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Imaging the magnetosphere with the SMILE Mission

C.-Philippe Escoubet[1], Chi Wang[2], Graziella Branduardi-Raymont[3], and the SMILE team[*]
[1]ESA/ESTEC, SCI-S, Noordwijk, Netherlands (philippe.escoubet@esa.int)
[2]NSSC/CAS, China
[3]MSSL/UCL, UK
[*]A full list of authors appears at the end of the abstract

The interaction between the solar wind and the Earth's magnetosphere, and the geospace dynamics that result, is one of the key questions in space plasma physics. In situ instruments on a fleet of solar wind and magnetospheric constellation missions now provide the most detailed observations of Sun-Earth connections over multiple scales, from the smallest of a few kilometres up to the largest of a few 10s of Earth radii. However, we are still unable to quantify the global effects of the drivers of such connections, including the conditions that prevail throughout geospace. This information is the key missing link for developing a complete understanding of how the Sun gives rise to and controls Earth's plasma environment and space weather. This is where SMILE (Solar wind Magnetosphere Ionosphere Link Explorer) comes in.
SMILE is a novel self-standing mission dedicated to observing the solar wind - magnetosphere coupling via simultaneous in situ solar wind/magnetosheath plasma and magnetic field measurements, soft X-ray imaging of the magnetosheath, magnetopause and polar cusps, and UV imaging of the Northern hemisphere auroral oval. Remote sensing of the magnetosheath and cusps with soft X-ray imaging is made possible thanks to solar wind charge exchange (SWCX) X-ray emissions known to occur in the vicinity of the Earth's magnetosphere. SMILE is a joint mission between ESA and the Chinese Academy of Sciences (CAS) due for launch at the end of 2024. SMILE science objectives as well as the latest technical developments jointly undertaken by ESA and CAS and the international instrument teams will be presented.

SMILE team: S. Sembay (University of Leicester, UK), L. Dai (NSSC/CAS, China), L. Li (NSSC/CAS, China), X.-X. Zhang (NCSW/CMA, China), J. Li (NSSC/CAS, China), D. Agnolon (ESA/ESTEC, The Netherlands), W. Raab (ESA/ESTEC, The Netherlands), C. Runciman (ESA/ESTEC, The Netherlands), F. Giannini (ESA/ESTEC, The Netherlands), A. Masson (ESA/ESAC, Spain), W. Chen (IAMC/CAS, China), X.-C. Zhu (IAMC/CAS, China), C. Forsyth (MSSL/UCL, UK), A. Read (University of Leicester, UK), E. Donovan (University of Calgary, Canada), E. L. Spanswick (University of Calgary, Canada), J. A. Carter (University of Leicester, UK), H. Connor (University of Alaska Fairbanks, USA), T. Sun (NSSC/CAS, China), A. Samsonov (MSSL/UCL, UK), J-H. Zheng (NSSC/CAS, China), D. Sibeck (GSFC/NASA, USA)