Temporal measurements of the interstellar helium focusing cone by the Magnetospheric Multiscale Mission (MMS)

Roman Gomez¹, Stephen Fuselier¹,², James Burch¹, Joey Mukherjee¹, Carrie Gonzalez¹, Karlheinz Trattner⁴, Michael Starkey¹, and Robert Strangeway³

¹Southwest Research Institute, Division 15: Space Science and Engineering, San Antonio, United States of America (rgomez@swri.edu)
²Department of Physics and Astronomy, University of Texas at San Antonio, San Antonio, United States of America
³Institute of Geophysics and Planetary Physics, University of California Los Angeles, Los Angeles, United States of America
⁴Laboratory for Atmospheric and Space Physics, University of Colorado-Boulder, Boulder, United States of America

The Sun and its associated heliosphere travels through the local interstellar medium (LISM) at a speed of 26 km/s. This results in a flow of neutral particles constantly entering the heliosphere at the same velocity. Neutral atoms with trajectories close to the Sun, which survive its ionizing radiation environment, become gravitationally attracted to it resulting in a focusing cone, a region of enhanced neutral density, downwind of the Sun. The increased neutral density in these regions leads to a higher density of pickup ions created by charge-exchange of the neutrals. In near-Earth orbit, the Magnetospheric Multiscale spacecraft (4 in all) have orbital apogees on the dayside during Earth’s annual encounter with the helium focusing cone (from mid-November to mid-December). Since launching in March of 2015, regular acquisitions with the Hot Plasma Composition Analyzers (HPCAs) have been conducted, with acquisitions from 2017 through 2019 occurring with a 29 RE apogee, ensuring long intervals in the pristine Solar Wind. We provide measurements of the focusing cone during the declining phase of the previous solar cycle. These measurements are used to investigate the effect of solar radiation on the focusing cone.