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Mapping solar wind speed with Metis observations

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The solar wind plays a central role in shaping the heliosphere and driving space weather, though the details of its origin and acceleration are full not fully understood. A major challenge lies in obtaining global measurements of the solar wind speed in the acceleration region, where remote-sensing techniques and indirect determinations are required. The Metis coronagraph on board the Solar Orbiter addresses this challenge by providing simultaneous polarized visible-light and ultraviolet H I Lyα observations, enabling the systematic derivation of solar wind speed maps via the Doppler dimming technique.
We present speed maps in the range 3.0–7.6 $R_{\odot}$, combining Lyα intensities with electron densities derived from polarized-brightness measurements. The sensitivity of inferred speeds to key coronal model assumption (electron temperature and kinetic neutral hydrogen temperature, as well as and helium abundance) is qualitatively assessed.
The results confirm the bimodal structure of solar wind as expected near solar minimum. The slow wind (100–200 km s−1) confined to the equatorial streamer belt and fast wind (250–400 km s−1) originates from polar coronal holes, separated by sharp transitions at mid-latitudes. Variations in coronal assumptions are found significantly impact the retrieved speeds, emphasizing the need for tighter constraints on coronal plasma conditions.
To place these results in a broader temporal and spatial context of this analysis, the same approach is applied to daily ultraviolet intensity maps reconstructed from UVCS/SOHO observations, combined with LASCO/SOHO white-light data, covering most of Solar Cycle 23. This extended dataset probes the solar wind acceleration region between 1.5 and 4.0 $R_{\odot}$, providing critical context for the interpretation of current Solar Orbiter measurements.
This work establishes Metis as a powerful tool for systematic, cycle-long mapping of the solar wind and provides valuable constraints for models of coronal heating and wind acceleration. Future perihelion observations will further refine these results.

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