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Poster
Open-field regions of the solar corona play an instrumental role in producing the ambient solar wind outflow, shaping the large-scale magnetic geometry of the surrounding heliosphere, and defining the propagation paths of the fast-traveling embedded structures such as coronal mass ejections. The accuracy of the existing space weather prediction models is limited by our ability to measure and map the open magnetic flux in the polar regions, and to establish realistic inner boundary conditions beyond the potential-field extrapolation of the photospheric magnetograms. The structure of the open field corona is closely coupled to its transient dynamics in the form of field-aligned plasma flows, packets of slow magnetosonic waves, propagating magnetic discontinuities, etc. In this talk, we review two groups of image analysis methods providing new insights into the spatiotemporal evolution of the open corona. The Quasi-Radial Field-line Tracing (QRaFT) method and code package enable an identification of the field-line geometry in the range of r=1.0-1.5 Rs based on high-resolution coronagraph observations. QRaFT detects and segments large-scale azimuthal gradients in the polarized brightness signal and computes their plane-of-sky orientation angles which approximate the magnetic field orientation. We present examples of QRaFT-based analysis of STEREO COR1 and MLSO KCor images and discuss how these results can be used to optimize global coronal and heliospheric models such as WSA/ADAPT/ENLIL. We also present a methodology for tracking transient propagating disturbances in the open-field corona based on the most recent implementation of the surfing transform (ST) technique and demonstrate its performance on the analysis of multiscale plasma outflows above a polar limb. We show that the ST-based tracking enables robust evaluation of local plasma velocity and acceleration across a wide range of radial distances, and can be efficiently used to quantify the kinematics of both small- and large-scale propagating disturbances constrained by the expanding quasi-radial field. We argue that a simultaneous application of the two groups of methods can provide important new information about the physical coupling between the geometry and the dynamics of the open-flux solar corona imaged by the upcoming PUNCH mission.
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