Title：Using Coordinated Observations in Polarized White Light and Faraday Rotation to Probe an Interplanetary Shock: Synthetic Imaging from Forward Modelling

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Abstract:
Coordinated remote-sensing imaging in white light and interplanetary scintillation (IPS) can routinely monitor a wide field of the inner heliosphere from multiple vantage perspectives. Interplanetary disturbances such as coronal mass ejections (CMEs) are continuously tracked in optics and radio. However, remote sensing signals are as a result of line-of-sight integration of weighted electron density. The weighted factors are determined by relative geometry between a light source, scattering sites, and a receiver. Specifically, the relative geometry refers to a Thomson scattering sphere in white light and a Fresnel filtering radius in IPS. At large elongations from the Sun, inversion and interpretation of remote sensing signals suffer from large uncertainties. For instance, kinematics models and unverified assumptions are used in interpreting brightness patterns of CMEs/blobs imaged by the STEREO/HIs, and reconstructing three-dimensional (3D) distribution of electron density from IPS tomography. Recently, I and my collaborators have made efforts of forward numerical modelling for better understanding ICMEs from remote sensing data. Specifically, we construct a numerical MHD model of the inner heliosphere, model CMEs and other transient disturbances, calculate synthetic observations in optics and IPS, compare modelling results with observation events, and suggest promising diagnostic methods used for the interplanetary space in exploiting future remote-sensing technological advances. It is likely to infer longitudinal location of an interplanetary shock from its brightness pattern in an optical sky map, based on the east-west asymmetry in its brightness and degree of polarization. Measurement of the interplanetary polarized brightness could significantly reduce the ambiguity in performing 3D reconstruction of local electron density from white-light imaging. Thus, forward modelling works such as our efforts are helpful in improving the understanding of interplanetary large-scale dynamics and remote-sensing imaging capabilities.