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Predicting the near-Sun and Interplanetary Magnetic Field of CMEs using photospheric magnetograms and coronagraph images

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Earth-directed Coronal Mass Ejections (CMEs) containing a strong southward magnetic-field component upon arrival at 1 AU statistically account for the most powerful geomagnetic storms. Unfortunately, though, we currently lack routine diagnostics of the magnetic field of CMEs and its evolution in the inner heliosphere and the interplanetary (IP) medium. We hereby present a simple, yet powerful and easy-to-implement, method to deduce the near-Sun and IP magnetic field entrained in CMEs, by using photospheric magnetograms of the solar source regions and multi-viewpoint coronagraph images of the corresponding CMEs. The method relies on the principle of magnetic-helicity conservation in low plasma-beta, flux-rope CMEs and a power-law prescription of the radial evolution of the CME magnetic field in the IP medium. We outline a parametric study based on the observed statistics of input parameters to calculate a matrix of magnetic-field solutions for 10000 synthetic CMEs. The robustness and possible limitations / ramifications of the method are deduced by a comparison with the distributions of the predicted CME-ICME magnetic fields at 0.3 and 1 AU using actual Messenger and ACE published observations.