

Tracking a coronal mass ejection and co-rotating interaction region as they travel from the Sun passing Venus, Earth, Mars and Saturn

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During 2010, there was a good alignment in the inner solar system between Venus, STEREO-B, Mars and Saturn. This has allowed the excellent opportunity to study the propagation of a CME and a closely occurring CIR from the Sun right through to the outer solar system. The CME erupted from the Sun at 01:30 UT on 20 June 2010 with a speed of ~600 km/s, observed from STEREO-B, SDO and LASCO. It arrived at Venus over 2 days later, which was about 3.5 days after a CIR is also detected by Venus Express. This CIR is also observed at STEREO-B and Mars, prior to the arrival of the CME. The CME is not directed towards the Earth, but the CIR is detected here less than 2 days after its arrival at Mars. Around a month later, a strong compression of the Saturn magnetosphere is observed by Cassini, which corresponds to this CIR impacting the planet. At this point it is determined that the CME and CIR have merged into a single solar transient. These transients are also modelled using the ENLIL with cone model. The arrival time of the CME at Venus, STEREO-B and Mars is predicted to within 20 hours of its actual detection, but the predictions for the arrival of the CIR showed greater differences from the observations, all being over 1.5 days early. Much better predictions of the CIR arrival times were found by extrapolating the travel time between different locations using the arrival times and speeds detected by STEREO-B and ACE. We discuss the implications of these results for understanding the propagation of solar transients.