The 2011 February 15 Coronal Mass Ejection: Reconciling SOHO and STEREO Observations in Quadrature

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The Large-Angle and Spectrometric Coronagraph (LASCO) on board SOHO observed a fast halo coronal mass ejection on 2011 February 15. The STEREO spacecraft were in qudrature with SOHO (STEREO-A ahead of Earth by 87° and STEREO-B 94° behind Earth), enabling CME measurement using the three spacecraft. The sky-plane speed measured by SOHO/LASCO is closely related to the expansion speed of the CME, while the radial speed was measured by STEREO-A and STEREO-B. In addition, STEREO-A and STEREO-B images measured the width of the CME, which is unknown from Earth view. From the SOHO and STEREO measurements, we confirm the relationship between the expansion speed (V_{exp}) and radial speed (V_{rad}) derived previously from geometrical considerations (Gopalswamy et al. 2009): = V_{rad} = ½ (1 + cot w) V_{exp}, where w is the half width of the CME. We can also measure the Earthward speed of the CME directly from the STEREO measurements. The travel time to Earth predicted from the Earthward speed using the Empirical Shock Arrival model is ~12 hours shorter than the actual travel time obtained from in situ measurements at L1. The primary reason for this discrepancy seems to be the interaction with the two preceding CMEs that slowed down the CME in question. The CME interaction is also confirmed from the radio enhancement observed by Wind/WAVES and STEREO WAVES experiments.