

# Earth-Affecting Coronal Mass Ejections Without Obvious Low Coronal Signatures

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We present a study of the origins of coronal mass ejections (CMEs) that were not accompanied by obvious low coronal signatures (LCSs) and yet were responsible for appreciable disturbances at 1 AU. These CMEs characteristically start slowly. In several examples, EUV images taken by the Atmospheric Imaging Assembly (AIA) on board the Solar Dynamics Observatory (SDO) reveal coronal dimming and large-scale brightening when we make difference images with long enough temporal separations, which are commensurate with the slow initial development of the CME. Data from the EUV Imager and COR coronagraphs of the Sun Earth Connection Coronal and Heliospheric Investigation (SECCHI) on the Solar Terrestrial Relations Observatory (STEREO), which provide the limb views of Earth-bound CMEs, greatly help us limit the time interval in which the CME forms and undergoes initial acceleration. For other CMEs, we find similar but weaker LCSs, and only with lower confidence. It is noted that even these less clear events may result in unambiguous flux rope signatures in in situ data at 1 AU. There is a tendency that the CME source regions are located near coronal holes or open field regions. This may have implications for both the initiation of the stealthy CME in the corona and its outcome in the heliosphere.

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