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Observations and Modeling of Stealth Coronal Mass Ejections

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Stealth coronal mass ejections (CMEs) are events in which there are almost no observable signatures of the CME eruption in the low corona but often a well-resolved slow flux rope CME observed in the coronagraph data. We present results from a three-dimensional numerical magnetohydrodynamics (MHD) simulation of the 2008 June 1-2 slow streamer blowout CME that Robbrecht et al. [2009] called «the CME from nowhere. » We model the global coronal structure using a 1.4 MK isothermal solar wind and a low-order potential field source surface representation of the Carrington Rotation 2070 magnetogram synoptic map. The bipolar streamer belt arcade is energized by simple shearing flows applied in the vicinity of the helmet streamer's polarity inversion line. The slow expansion of the energized helmet-streamer arcade results in the formation of a radial current sheet. The subsequent onset of expansion-driven flare reconnection initiates the stealth CME while gradually releasing ~1.5E+30 erg of stored magnetic energy over the 20+ hour eruption duration. We show the energy flux available for flare heating and flare emission during the eruption is approximately two orders of magnitude below the energy flux required to heat the ambient background corona, thus confirming the « stealth » character of the 2008 June 1-2 CME's lack of observable on disk signatures. We also present favorable comparisons between our simulation results and the multi-viewpoint SOHO-LASCO and STEREO-SECCHI coronagraph observations of the pre-eruption streamer structure and the initiation and evolution of the stealth streamer blowout CME.