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The CME of 22 October 2003: 3D shape reconstruction and propagation from LASCO/C2 and C3 observations

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Since their discovery in coronagraphic white-light images, the determination of the three-dimensional morphology and propagation of coronal mass ejections (CMEs) has been a major question of coronal physics, and a challenge to the observers. Two-dimensional images are generally insufficient to provide anything more than an idea of the global and internal structures of a CME. Accordingly, very simple models have been considered such as the ice-cone. The question has motivated the STEREO mission are several attempts are currently underway to retrieve 3D information on CMEs from stereoscopic views. There are however favorables cases where the relatively simple morphology of a CME and the geometry of the observations allow to perceive its global shape, so that forward modeling based on an a-priori shape model can be attempted, and the resulting synthetic images are compared and fitted to the observations. We will present the case of the CME detected and tracked by the LASCO-C2 and C3 instruments on 22 October 2003 which is amenable to such an approach. The global shape of this CME on the images however requires the introduction of an elaborated shape model, an asymmetric plasma cloud. The images are first processed in order to remove most of the background or foreground coronal structures (essentially streamers) which are superimposed on the CME. Using the above cloud model, we generate synthetic images which are fitted to the observed images. The resulting parameters allow a full characterization of the 3D shape and propagation of the CME.