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Investigating the physical properties of coronal mass ejections and related phenomena with white light and ultraviolet observations

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Coronal Mass Ejections (CMEs) are one of the most impressive manifestations of the solar activity and also one of the principal drivers of Space Weather.
During CMEs huge amounts of solar gas and magnetic field are released into the interplanetary space. As CMEs expand in the solar corona, they can trigger shock waves that may in turn accelerate solar energetic particles (SEPs), while the ejected material can give origin to interplanetary magnetic clouds which might eventually travel towards the Earth and have the potential of causing severe consequences on human technologies and the terrestrial environment.
Over almost the last 20 years CMEs have been observed in white light (WL) and ultraviolet (UV) by the SOHO and STEREO satellites. Coronagraphic WL images have been extensively used with various techniques to derive speeds, masses, and geometrical properties of CMEs, as well as to validate theoretical models of initiation and propagation of such phenomena. Nevertheless, possible explanations on how CMEs originate and evolve are still subject of open debate.
In a few recent studies we demonstrated that combination of WL and UV data analyses can provide unique information on the heating and dynamics of the plasma embedded in the core of CMEs and allow the determination of several physical plasma properties, such as the strength of the coronal magnetic field encountered by the shock wave associated with a CME.
These results are very important in the perspective of coronagraphic observations that will be available from the METIS instrument on board the ESA-Solar Orbiter spacecraft: METIS will acquire simultaneous images of the solar corona in WL and UV (HI Lyman-alpha) to which the methods presented here will be promisingly applied.

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