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Oral
(Invited Talk)
One of the greatest challenges in coronal mass ejection (CME) research is to reach a full characterisation in 3D of their structure and evolution. In the remote-sensing regime, the coronal and heliospheric propagation of CMEs is usually tracked via white-light imagery taken from near Earth or by a handful of probes in heliocentric orbits within 1 au from the Sun. After the launch of the first spacecraft equipped with solar imagers off the Sun–Earth line in 2006, stereoscopic techniques to determine the morphology and kinematics of CMEs began to appear. For example, the most common procedures to analyse the propagation of CMEs through the solar corona to date consist of fitting a pre-defined geometric structure to simultaneous white-light images from two or three perspectives, a method known as forward modelling. However, it is well known that the available observing viewpoints throughout the heliosphere are often insufficient to recover an accurate 3D representation of a given eruption.

To overcome the limitations arising from an insufficient number of observers, our International Space Science Institute (ISSI) team has resolved to focus on state-of-the-art magnetohydrodynamic (MHD) simulations of CMEs and synthetic white-light data using the CORonal HELiospheric (CORHEL) model. This is to ensure that there are no limitations not only on the number of available observers, but also on their relative positions. Our goal is to test more traditional forward-modelling techniques as well as less-explored inverse-modelling methods (via discrete tomography) on a number of synthetic spacecraft configurations, exploiting both total and polarised brightness imagery, to determine the optimal conditions for recovering the known 3D structure of the simulated CMEs. The ultimate aim of this endeavour is not only to better inform the planning and development of future missions, but will also provide a benchmark for current CME propagation models and forecasting tools. In this presentation, we will summarise the efforts of our ISSI team in terms of characterising CMEs in 3D and highlight the main results obtained to date.

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Invited or Virtual?

(Invited Talk)