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First detection of small-scale helical flows in the void of a Coronal Mass Ejection with high-cadence coronagraphic images acquired by the Metis coronagraph on-board Solar Orbiter

On March 26, 2022 the ESA Solar Orbiter mission observed the early evolution of a Coronal Mass Ejection (CME). On that day the spacecraft was at a heliocentric distance of 0.32 AU, and a longitude separation from Earth of 74.5 degrees. The CME source region shows no pre-existing filament or flux-ropes. The event was first observed in the inner corona by the EUV telescope, showing the initial propagation of the flux-ropes in the EUV. Higher up, the event was observed by Metis with the Visible Light channel with an unprecedented time cadence of 20 sec, and a spatial resolution of 20" corresponding to about 4600 km per bin. The sequence of total brightness images shows for the first time small-scale flows going on inside the expanding flux-ropes surrounded by multiple nested arch-shaped features. These plasma motions, not observed by EUV, could be connected with the unknown forces accelerating the eruption. Running difference images built with the cadence offered by previous coronagraphs show the well-known three-part structure of this event, but the real identification of these different classical CME parts is less evident in the high-cadence Metis images. Hence, these observations provide new insight into what is normally identified as the global structure of CMEs.

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