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The multi-spacecraft observations of the sheath region of April 2020 magnetic cloud and the associated energetic ions

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The sheath regions driven by coronal mass ejections (CMEs) are large-scale heliospheric structures. Turbulent and compressed sheaths could contribute to the acceleration of charged particles in interplanetary space, but their internal structure and its relation to energization process is still poorly understood. We report here the analysis based on observations by Solar Orbiter, BepiColombo and the L1 spacecraft to explore the structure of a coronal mass ejection (CME)-driven sheath and enhancements of energetic ions that occurred on April 19-20, 2020. Our detailed analysis of the magnetic field, plasma and particle observations show that the enhancements were related to the Heliospheric Current Sheet crossings related to the reconnecting currents sheets in the vicinity of the shock and a mini flux rope that was compressed at the leading edge of the CME ejecta. This study highlights the importance of smaller-scale sheath structures for the energization process. These structures likely formed already closer to the Sun and were swept and compressed from the upstream wind past the shock into the sheath. The upcoming observations by the recent missions (Solar Orbiter, Parker Solar Probe and BepiColombo) provide an excellent opportunity to explore further their role.

Student poster?

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