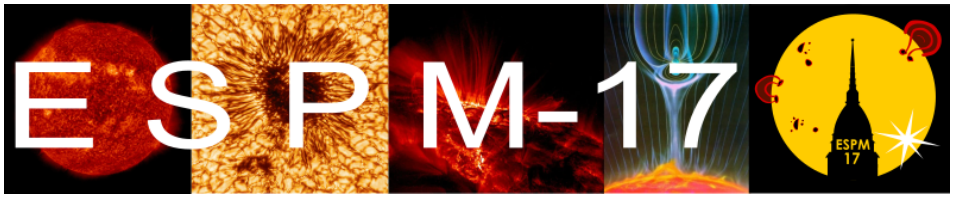

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The September 5, 2022, coronal mass ejection characterized by remote observations, numerical simulations, and in situ measurements

Open problems in solar and heliospheric physics are (i) how charged particles are accelerated up to high energies and (ii) how they are transported in the inner heliosphere. Among candidates for particle acceleration there are shocks driven by coronal mass ejections (CMEs). We started a new research project (*) whose main methods are remote observations, numerical simulations, and in situ measurements. Here, we show the results of applying these approaches to the fast CME event of September 5, 2022, which was measured in situ by Parker Solar Probe (PSP) and Solar Orbiter, and observed remotely by Stereo-A, SOHO and PSP.

We carry out the reconstruction of the CME by using SOHO/LASCO, STEREO-A/COR2, and PSP/WISPR data. The obtained CME parameters are used as an input for the RIMAP simulation, which also uses the in-situ solar wind data to describe more accurately the initial interplanetary conditions. Then we analyze the in-situ Solar Orbiter measurements to check the results of the RIMAP simulation and to study the CME-driven shock properties, the level of magnetic turbulence around the shock and energetic particle acceleration due to the shock. As preliminary results, we find that the energetic particles differential flux at Solar Orbiter has a spectral index harder than that predicted by diffusive shock acceleration for the measured compression ratio. The possible reasons for such a discrepancy are discussed.

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Primary author: Prof. ZIMBARDO, Gaetano (University of Calabria, Rende, Italy and INAF, Italy)

Co-authors: Dr BEMPORAD, Alessandro (Istituto Nazionale di Astrofisica (INAF)); REALE, Fabio (Istituto Nazionale di Astrofisica (INAF)); REALE, Fabio (Università degli Studi di Palermo); FRASSATI, Federica (Istituto Nazionale di Astrofisica (INAF)); Dr NISTICÒ, Giuseppe (Università della Calabria); Dr PRETE, Giuseppe (Università della Calabria); PAGANO, Paolo (Università degli Studi di Palermo); PAGANO, Paolo (Istituto Nazionale di Astrofisica (INAF)); SUSINO, Roberto (Istituto Nazionale di Astrofisica (INAF)); BIONDO, Ruggero (Istituto Nazionale di Astrofisica (INAF)); MANCUSO, Salvatore (Istituto Nazionale di Astrofisica (INAF)); PERRI, Silvia (Istituto Nazionale di Astrofisica (INAF))

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