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Oral
(Invited Talk)
Space weather, a field that studies the conditions in the solar atmosphere and their effects on the heliosphere, is of paramount importance, particularly in understanding the space environment of the Earth. The main drivers of interplanetary shocks and space weather disturbances are Coronal Mass Ejections (CMEs). The internal magnetic configuration of the CME is a key parameter that determines the geo-effectiveness of the CME impact. The potential impact of strong CMEs directed towards Earth is severe, and their prediction is crucial in mitigating possible damages. This underscores the necessity of efficient space weather prediction tools, which can produce timely forecasts for the CME arrival at Earth and their strength (shock, momentum density, magnetic field, etc.) upon arrival.

The novel heliospheric model Icarus (Baratashvili et al. 2025), a product of the MPI-AMRVAC framework (Keppens et al. 2023), revolutionizes our ability to model the heliospheric solar wind and real CME events. By solving the MHD equations in the co-rotating reference frame with the Sun, we achieve a stationary solution after obtaining the relaxed solar wind in the domain for a particular magnetogram. This paves the way for injecting different CME models on top of this stationary background solar wind. To enhance the simulations, we've implemented advanced techniques, such as adaptive mesh refinement and gradual radial grid stretching.

Recently, the model was upgraded to support upgrading inner boundary conditions dynamically, where magnetograms are upgraded hourly. This way, the solar wind is no longer stationary in the domain as new information propagates from the inner boundary. Additionally, CMEs are injected on top of the varying solar wind. Baratashvili et al. 2025 found that the non-magentized and magnetized CME models evolve differently when travelling in the steady and dynamic solar wind. In this work we focus on a CME observed by PUNCH and model it with a magnetized and a non-magnetized CME model in Icarus. The generated synthetic white-light images are compared to PUNCH observations to estimate a more realistic CME model representation.
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