



Mesoscale Structures in the CME-Solar Wind Interaction

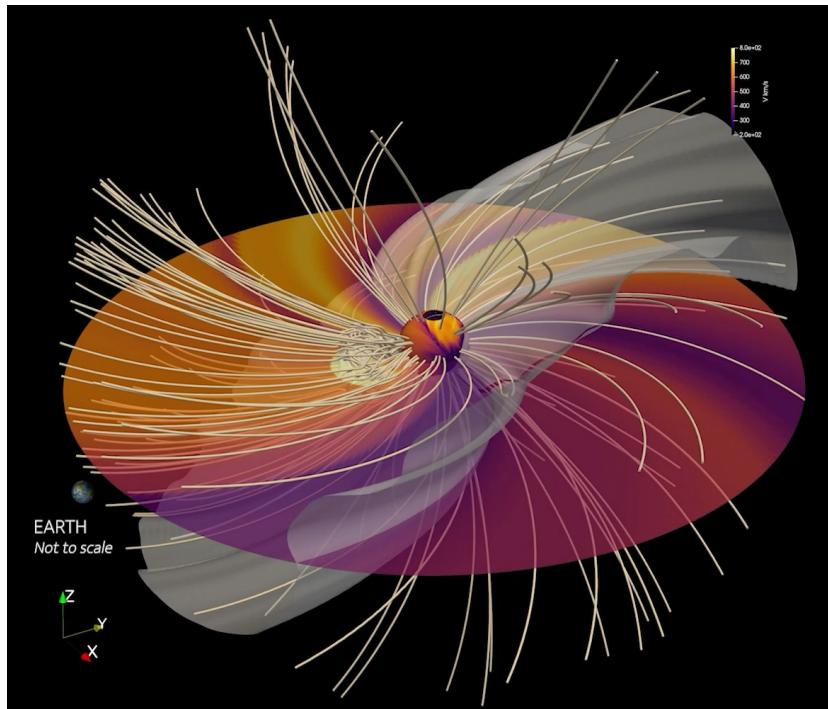
Insights from High-Resolution GAMERA Heliospheric Simulations

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GAMERA-Helio Model with Gibson-Low CME

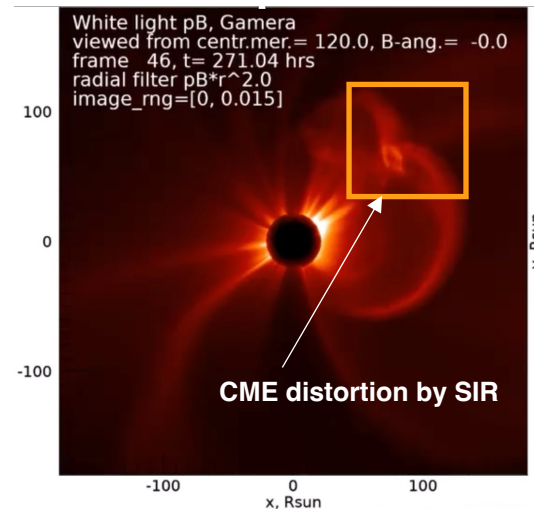
- Solar wind background is driven by the the coronal semi-empirical Wang-Sheeley-Arge model with ADAPT magnetograms (*Arge et al 2004*).
- A CME in the outer corona is represented by the Gibson-Low MHD model (*Gibson&Low 1998*).
- Details of model coupling in *Provornikova et al. (2024)*.



GAMERA-Helio CME simulation in the solar wind background driven by WSA-ADAPT

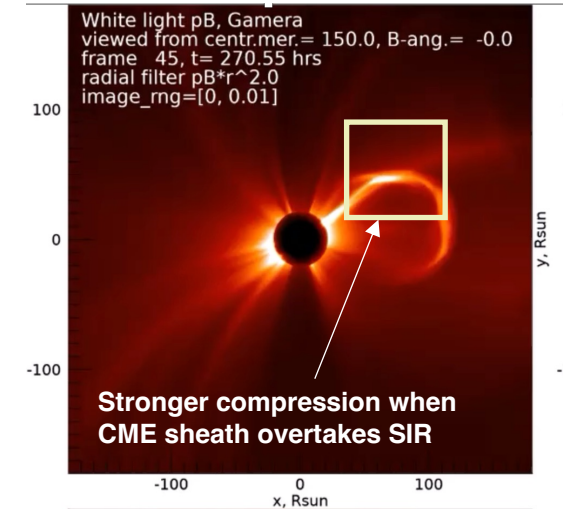
Examples of ICME-solar wind interaction in synthetic images

Wide ICME interacts with a SIR: distorted front

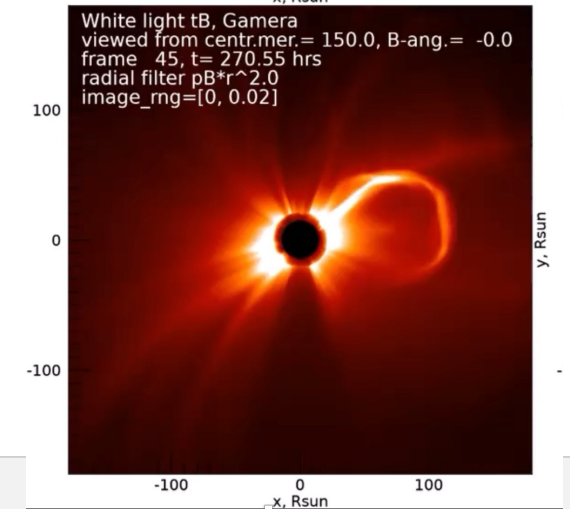
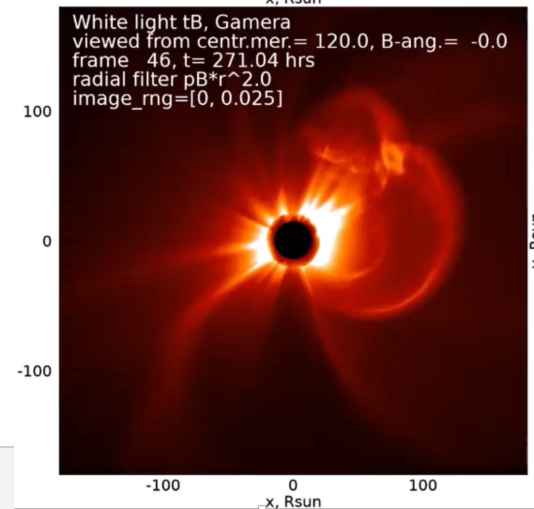


CME distortion by SIR

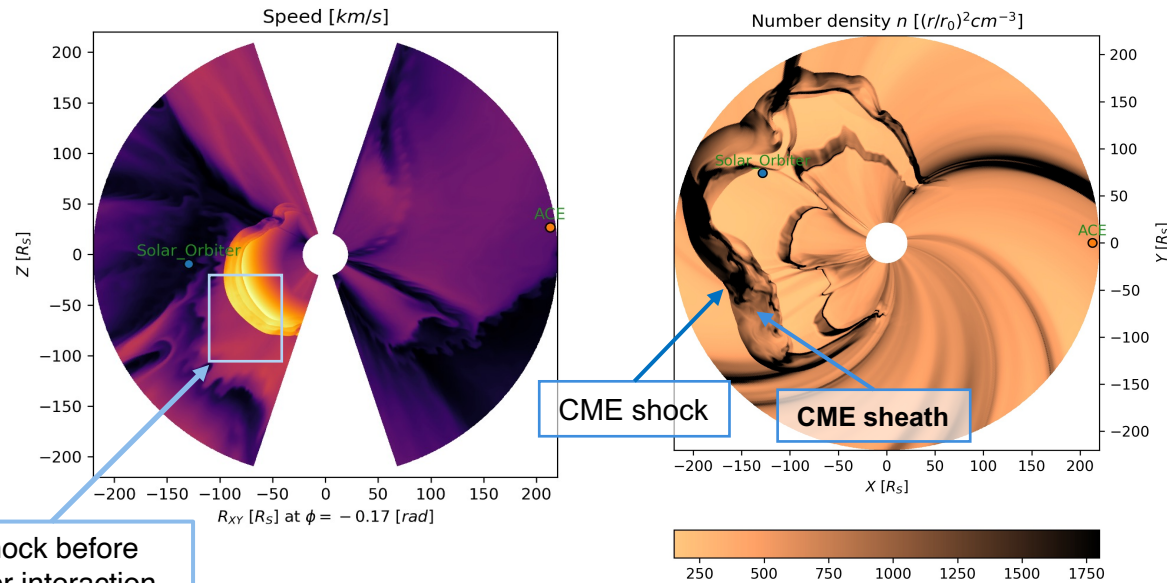
ICME sheath overtakes SIR : higher plasma compression, brighter signal



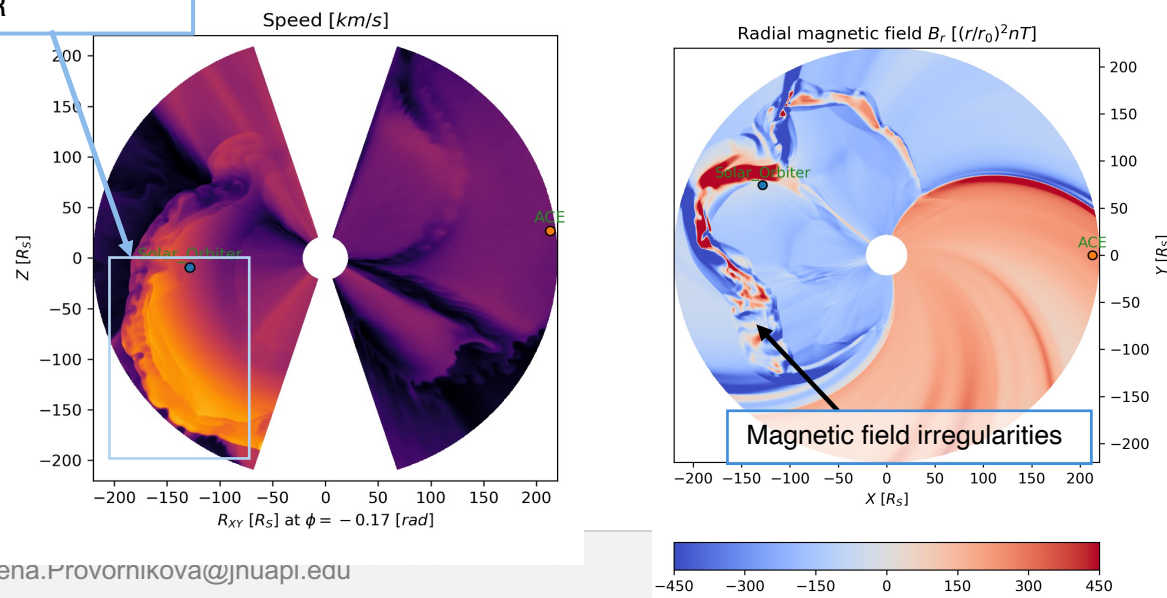
Stronger compression when CME sheath overtakes SIR



Preparing for PUNCH with high-resolution GAMERA simulations of ICMEs and solar wind



CME shock before and after interaction with SIR



High-resolution simulations offer an opportunity to understand the details of ICME-solar wind interaction at global and mesoscales that PUNCH will observe

- **CME shock dynamics**
 - Distortions by ICME-SIR interaction
 - Irregularities and ripples at mesoscales
- **CME sheath**
 - Developing substructures at mesoscales with compressions and magnetic field variations
- **CME structure**
 - Distortions shaped by background solar wind variability
- **SIR dynamics**
 - Velocity shears with possible formation of instabilities (Mostafavi et al. 2022)

GAMERA resolution
1024x512x1024