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Oral
(Invited Talk)
Coronagraphic observations enable the monitoring of coronal mass ejections through scattered light from free electrons, and allow for an estimation of the density, velocity, and propagation direction of the ejected solar plasma. This is essential to determine the topology of CMEs and their potential space weather impacts on Earth. However, the reconstruction of the 3D plasma distribution is challenging, due to the optically thin medium and complex image formation based on angle-dependent scattered light.
We present a novel method for 3D tomographic reconstructions of the Heliosphere based on coronagraphic observations of polarized and total brightness. Our method leverages Neural Radiance Fields to estimate the electron density in the Heliosphere through a ray-tracing approach. Reconstructions based on a single viewpoint are typically insufficient for estimating the 3D plasma distribution. Therefore, we introduce additional physical constraints for continuity, solar wind speed, and propagation direction, to provide physics-informed tomographic reconstructions.
In preparation for the PUNCH mission, we utilize synthetic observations of CMEs based on GAMERA simulations and estimate the model performance in dependence of the number of viewpoints, physical constraints, and CME configuration.
With this we provide a first step towards physics-informed 3D CME tomography, to advance our understanding of the topology and propagation of Heliospheric plasma. We conclude with an outlook where this approach could be coupled with the inner Heliosphere and EUV observations.
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