SPD Thomas Metcalf Travel Award Report

Solar Orbiter / IRIS / ADITYA Workshop | Berlin, Germany | March 16-19, 2026

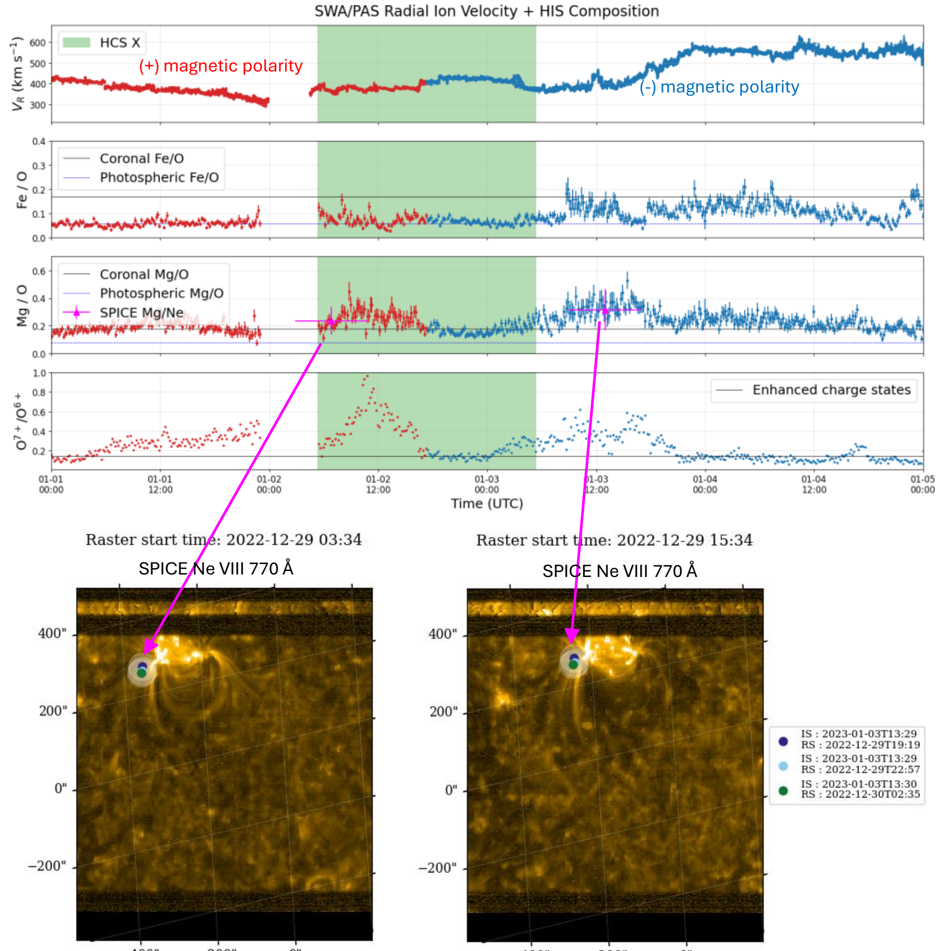
Tania Varesano was born and raised in Paris, France. She moved to the US after completing her Master's degree in signal processing at the Grenoble Institute of Technology. She is now a Ph.D. candidate in the Smead Aerospace and Engineering Sciences at the University of Colorado, Boulder, where she works under the supervision of Dr. D.M. Hassler and Prof. Delores Knipp. Her research focuses on using data from Solar Orbiter, specifically imaging spectroscopy, to investigate the connection between phenomena happening at the surface of the Sun and the solar wind observed in the heliosphere.

Meeting contribution

Oral presentation: Probing Transition Region–Solar Wind Connectivity with SPICE and SWA/HIS Instruments

One of the fundamental objectives of the Solar Orbiter mission is to establish the physical connection between the solar atmosphere and the solar wind in the heliosphere. Understanding how and where the solar wind originates, and how its properties evolve during propagation, remains a central challenge in heliophysics with direct implications for space weather prediction.

This study exploits the unique capability of Solar Orbiter to perform coordinated remote-sensing and in-situ measurements. Observations from the SPICE instrument are used to characterize plasma conditions in the transition region and low corona, with a particular focus on elemental composition diagnostics such as the First Ionization Potential (FIP) bias. These measurements are combined with in-situ plasma observations from the SWA instrument suite, enabling direct comparison between coronal source regions and the solar wind detected in the heliosphere.



To bridge these two regimes, the analysis incorporates magnetic connectivity and solar wind propagation modeling using the ADAPT-WSA model. This framework provides estimates of solar wind footpoints and enables the identification of large-scale heliospheric structures, such as heliospheric current sheet crossings, which serve as key markers linking remote and in-situ observations.

Combining compositional diagnostics, magnetic field context, and modeling allows for the systematic tracing of solar wind streams back to their coronal sources. Even though the model has uncertainties, first results show extremely encouraging results, shown in the figure, where we connect the solar wind source to its in-situ measurement.

Overall, this work exemplifies the core science enabled by Solar Orbiter: quantifying Sun–heliosphere connectivity through the integration of remote sensing, in-situ measurements, and modeling. Such studies are essential for advancing a predictive understanding of the solar wind and improving our ability to model and forecast space weather.

I am deeply grateful to the SPD/Thomas Metcalf Travel Award Committee for this honor. Their support enabled me to engage directly with collaborators I would not have otherwise met and to receive invaluable advice and feedback that will significantly inform and strengthen my ongoing thesis work.