**Project Title:**
Connecting theory and simulations of turbulence in the inner heliosphere with single-point measurements by Solar Probe Plus and Solar Orbiter

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**Project Information:**
The primary objective of this project is to develop new methods and tools to better understand the relation between single-point space-craft measurements and the three-dimensional physical properties of the solar wind in the inner heliosphere, which is critical for understanding and interpreting measurements from the upcoming Solar Probe Plus (SPP) and Solar Orbiter (SO) missions. The need for new methods derive in part because in this region, many of the assumptions that are usually made at higher heliocentric distances breakdown, thus requiring novel data-analysis methods in order to obtain meaningful quantitative predictions that can be compared to theoretical and numerical models of the solar wind, as well as other processes that impact life and society here on Earth. In order to achieve the goals of this project, we will produce synthetic data simulating measurements from instruments on board these missions by flying virtual probes in simulations of Alfvenic turbulence. The probe's trajectories will be chosen to simulate planned orbits of the Solar Probe Plus and Solar Orbit missions. We aim to develop new analytical methods to establish meaningful connections between the synthetic measurements and three-dimensional properties of the solar wind. The methods will be validated using the full three-dimensional structure of the underlying fields that are completely known and controlled in the simulations. The simulations will be performed inside a narrow magnetic flux tube that models a coronal hole extending from the solar surface into the solar corona to about 60 solar radii (0.3 AU), using a fully developed spectral element code called IRMHD (Inhomogeneous Reduced Magnetohydrodynamics). The IRMHD code is thus far the only code capable of simulating broad-spectrum non-compressive turbulence while resolving the inhomogeneity of the background profiles, including the outflow velocity, without approximating the nonlinear terms in the governing equations. The outcomes of this project are timely, given that they will be available when SPP and SO become operational, enabling future comparisons with SPP measurements that will contribute significantly to the science return of this pioneering mission.

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**Citations:**

**Summary:** no summary

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