



Regional Introduction to Plasma Processes



Project Title: Turbulence and Magnetic Reconnection near the Heliospheric Current Sheet

Project Reference Code: Zhao_UAH

Name of Project Leader: Lingling Zhao

Host Facility: University of Alabama in Huntsville

Internship Location: CSPAR, Cramer Research Hall, UAH

Host Facility Location: 320 Sparkman Drive, NW, Huntsville, AL 35805

Project Description:

The interaction between magnetic reconnection and turbulence is a long-standing problem in collisionless plasmas. Magnetic reconnection, as a fundamental physical process related to energy conservation, has been widely invoked to explain the energization and heating of space plasma through the conversion of magnetic energy into plasma kinetic energy. On the other hand, turbulence is a universal process that cascades energy from large-scales to smaller scales, eventually converting the kinetic and magnetic energy of turbulence into thermal energy through collisions and interactions at the smallest scales, thereby effectively heating the particles within the plasma. Magnetic reconnection can play an important role in accelerating the energy transfer in the MHD turbulence, thereby further promoting the heating process. In addition, the energy transfer process of turbulence results in the generation of intermittent structures such as current sheets and vortices, which are conducive to the formation of secondary reconnection sites. Magnetic reconnection occurs repeatedly in the heliospheric current sheet (HCS) due to the variability of the solar wind. In this project, we will investigate the interplay between turbulence and reconnection near the HCS from Parker Solar Probe in-situ measurements. We will conduct a comparative study of the turbulence spectra and cascade rate and their association with the reconnection exhaust characteristics near the HCS observed in the near-Sun environment.

Disciplines: Space Physics

Importance:

The results will help validate our turbulent transport models and particle energization theory. Students can also learn how to analyze spacecraft data to obtain scientific results during their internship.

Requirements:

- **Preferred Major**
 - Physics, Computer Science. Accept STEM students if necessary
- **Class work**
 - Physics, Computer Science, Math
- **Programming knowledge**
 - Python
- **Software knowledge**
 - Python numpy, scipy, PySPEDAS
- **Other**



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Biography:

Dr. Lingling Zhao is an Assistant Professor of the Department of Space Science (SPA) at The University of Alabama in Huntsville (UAH). She is currently working on the solar wind turbulence and energetic particles observed by Parker Solar Probe and Solar Orbiter. She developed the graduate course “Analysis of Spacecraft Data” for the Department of Space Science at UAH.

Is U.S. citizenship required to participate in this project? No

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Name(s) of Mentor(s) and contact information: Lingling Zhao, (lz0009@uah.edu)

Internship Coordinator/ HR manager: Laura Provenzani, lp0020@uah.edu

The name and contact information of personnel at the host facility is provided for further assistance with questions regarding the host facility or the project.

Interns will not enter into an employee/employer relationship with the host facility. No commitment with regard to later employment is implied or should be inferred.