Project Title:
Evolution of Turbulence in the Inner Heliosphere

Project Reference Code:
UAH-Adhikari

Host Facility:
The University of Alabama in Huntsville

Host Facility Location:
301 Sparkman Dr.
Huntsville, AL 35899
https://www.uah.edu/

Project Description:
Magnetized turbulence is commonly present throughout the solar wind, from the solar corona to the heliopause and possibly even in the interstellar medium. The solar wind has been used to study magnetohydrodynamic (MHD) turbulence from the beginning of the space age. Turbulence is thought to be responsible for several interesting phenomena in the solar wind, such as the solar wind heating, the coronal heating, acceleration of the solar wind, scattering of the solar energetic particles, and so forth. As the solar wind expands with distance, turbulence evolves with increasing heliocentric distance. The evolution of solar wind turbulence in the heliosphere can be described by turbulence transport model equations. Many turbulence transport model equations have been proposed to explain the evolution of turbulence in the solar wind. Zank et al. (1996) first proposed a theoretical model of turbulence to describe the evolution of fluctuating magnetic energy, and the correlation length of the magnetic field fluctuations throughout the heliosphere.

The main purpose of this project is to understand how turbulence evolves with heliocentric distance between 0.3 and 1 astronomical unit (au) and its role in solar wind heating. In this project, the student will analyze the magnetometer and plasma data from Helios 2 spacecraft and solve a simple form of turbulence transport model equations (Zank et al. 2012). In addition, the nonlinear term derived from an Iroshnikov-Kriachnan (IK) phenomenology is also employed in the turbulence model equations. Therefore, s/he will solve two system of turbulence transport model equations, and calculate the energy in forward/backward propagating modes, the residual energy, the fluctuating kinetic and magnetic energy, the correlation length, and the solar wind temperature. These theoretical results are compared with Helios 2 measurements. If time permits, s/he will compare the theoretical results with the measured results of the Parker Solar Probe. In this project, s/he will learn to solve turbulence transport model equations and data analysis technique.

Disciplines:
Physics, Math, Computer Science, Space Science

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

Internship Location and COVID-19 related Backup Plan
The internship location is the University of Alabama in Huntsville. Due to the COVID-19 pandemic, we are preparing multiple options to ensure that the internship will take place. We are looking at least at an in-person, hybrid, and fully virtual option. For any in-person component we will ensure that there is adequate physical spacing between workspaces, following all university cleaning protocols.

Name(s) of Mentor(s) and contact information:
Laxman Adhikari (la0004@uah.edu)
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Internship Coordinator/ HR manager:
Dana Waller (dsw0012@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.