



# Regional Introduction to Plasma Processes



**Project Title:** Estimation of proton heating rate due to interplanetary magnetic switchbacks observed by Parker Solar Probe

**Project Reference Code:** Adhikari-UAH

**Name of Project Leader:** Laxman Adhikari

**Host Facility:** University of Alabama in Huntsville

**Internship Location:** Cramer Research Hall

**Host Facility Location:** 301 Sparkman Drive, Huntsville, AL, 35899

**Project Description (roughly 300 words):** Structures known as “switchbacks” were detected by the Parker Solar Probe (PSP) during its first and subsequent encounters with the Sun and its extended solar corona. These switchbacks were first recognized as sudden jumps in the solar wind plasma flow, characterized by a sharp change in the magnetic field direction - at least 45 degrees from the background orientation - before returning to the original direction within more than 10 seconds. Magnetic switchbacks are believed to be important in heating the solar corona and solar wind and accelerating the solar wind. In this study, we analyze data from several PSP encounters and identify “switchbacks” to study the heating rate of the proton (and electron) in the inner heliosphere. We will compare this heating rate with that observed during quiet periods (i.e., when no switchbacks are present) as a function of heliocentric distance. This study will reveal the role of “switchbacks” in heating the solar wind proton (and electron).

**Disciplines:** Physics, Math, Computer Science

**Importance:** After PSP discovered " switchbacks, " the science community has been interested in them. However, there is a debate about their identity. Several ideas have been put forward about their origin, but it is still unclear. The study we propose in this project will help us understand how they heat the solar wind plasma.

## Requirements:

- **Preferred Major**
  - o Physics, Math or Computer Science
- **Class work**
  - o Physics, Math or Computer Science
- **Programming knowledge**
  - o Python or Matlab
- **Software knowledge**
  - o NA
- **Other**



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## **Biography (roughly 100-150 words):**

The project leader's name is Dr. Laxman Adhikari. Dr. Adhikari is an Assistant Professor at the department of space science in the University of Alabama in Huntsville. Dr. Laxman Adhikari has over 8 years of experience in heliospheric space plasma research, specializing in magnetohydrodynamic (MHD) turbulence transport modeling and analyzing the spacecraft data sets. He has compared his turbulence-driven solar wind model results with Parker Solar Probe (PSP), Solar Orbiter (SolO), Helios 2, Ulysses, Voyager 2, WIND, ACE, Cassini, Pioneer 10, and New Horizons Solar Wind Around Pluto (NH SWAP) measurements.

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

## **Contact information:**

Cramer Research Hall (room # 2029)

## **Name(s) of Mentor(s) and contact information:**

Dr. Laxman Adhikari ([la0004@uah.edu](mailto:la0004@uah.edu))

## **Internship Coordinator/ HR manager:**

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