



Regional Introduction to Plasma Processes



Project Title: Study of coaxial plasma gun discharge at various conditions for torsional magnetic reconnection

Project Reference Code: Xu-UAH

Name of Project Leader: Gabe Xu

Host Facility: University of Alabama in Huntsville

Internship Location: Johnson Research Center

Host Facility Location: 301 Sparkman Dr, Huntsville AL, 35899

Project Description:

Torsional magnetic reconnection (TMR) is a 3D reconnection process that is theorized to occur on the Sun. It is much less studied than the more common 2D X-type reconnection. In TMR, rotating field perturbations applied to a null point background magnetic field cause field slippage and conversion of stored magnetic energy into plasma thermal and kinetic energy. The unique behavior of TMR is the plasma heating and acceleration can be uni-directional and produce a high velocity plasma jet. This makes it a potential candidate for high efficiency plasma propulsion, as well as for plasma jet driven magneto-inertial fusion. We are currently building an experiment comprised of a coaxial plasma gun (CPG) and a null point field coil to study TMR in the laboratory. In this project, the student will work with UAH research staff and graduate students to conduct experiments with the CPG to characterize its behavior under different input conditions such as pressure, gas puff duration, and discharge power. The student may also assist with data analysis, electrical setup, and coil design.

Disciplines: Physics, engineering

Importance:

The research is mainly basic plasma physics to study the reconnection process. However, the knowledge has applications to plasma propulsion for space and plasma-jet fusion.

Requirements:

- **Preferred Major**
 - Any engineering, physics, math
- **Class work**
 - None required, though physics 2: electromagnetics would be beneficial
- **Programming knowledge**
 - Some programming experience with python, Matlab, or similar codes would be beneficial for data analysis
- **Software knowledge**
 - NA
- **Other**



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Biography:

Dr. Xu is a professor in the Mechanical and Aerospace Engineering (MAE) department at UAH. His research falls under the broad umbrella of plasma science and engineering and propulsion. The active research topics include laser production plasmas, magnetic reconnection, atmospheric pressure plasmas and their effect on biological materials. The research is 90% experimental, with some use of commercial computational models as necessary. Dr. Xu is also the faculty advisor for the UAH chapter of AIAA, and organizes the graduate recruitment effort for the MAE department. He is a member of APS, IEEE, and an Associate Fellow of AIAA.

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

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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.