



Regional Introduction to Plasma Processes



Project Title: Study of diamagnetic cavity formation in laser produced plasmas

Project Reference Code: Xu-UAH

Name of Project Leader: Gabe Xu

Host Facility: The University of Alabama in Huntsville

Internship Location: Johnson Research Center

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

Project Description (roughly 300 words):

We are currently using pulsed lasers (532 nm at ~300 mJ and 6 ns) to produce small but dense plasma by ablating graphite targets. These plasma are generated inside magnetic fields of different topologies in order to study the plasma-magnetic field interactions. One of the questions of interest is the formation and growth of the diamagnetic cavity formed when the plasma expands and pushes against the external magnetic field. This causes compression of the magnetic flux, kind of like if you blow up a balloon in a bucket of water. The water is the magnetic field, and the expanding balloon is the plasma pushing out the magnetic field. In this project, the student will work with UAH graduate students and research staff to conduct experiments in laser produced plasmas in a small vacuum chamber. The student will use diagnostics such as synchronized ICCD imaging, Langmuir probes, B-dot probes, and optical emissions spectroscopy to study the plasma and diamagnetic cavity.

Disciplines: Physics, Engineering

Importance:

The research is mainly basic plasma physics, however the knowledge has applications to magnetic nozzles for pulsed fusion propulsion for space travel, and magneto-inertial fusion energy conversion. The results can help design the nozzle for future fusion propulsion systems, or power extraction coils for pulsed fusion power plants.

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 (roughly 100-150 words):

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

Contact information:

Gabe.xu@uah.edu

256-824-5083

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

Zachary White (zw0015@uah.edu)

Ian Wagner (irw0004@uah.edu)

Rachel Reuben (rr1422@uah.edu)

Internship Coordinator/ HR manager:

Laura Provenzani (lp0020@uah.edu)