Project Title:
Imaging techniques to investigate filamentary structures in low temperature plasmas at high magnetic fields

Project Reference Code:
AU-Chakraborty

Host Facility:
Auburn University

Host Facility Location:
315 Roosevelt Concourse
Auburn, AL 36849
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Project Description:
In a series of controlled experiments at the Magnetized Dusty Plasma Experiment (MDPX) at Auburn University we have observed the formation of filamentary structures in capacitively-coupled, rf generated plasmas at high magnetic field ($B \geqslant 0.5$ T), under a variety of power, pressure, and applied magnetic field conditions. These elongated plasma filaments, when viewed from the side, appear as bright vertical columns aligned parallel to the magnetic field. These structures can either be stationary or mobile, depending on the experimental conditions. In a certain parameter range of neutral pressure, power and magnetic field, a regime of individual filaments with rotating spiral arms has been identified by visible imaging from the top of the machine. These are typically due to instabilities of the original vertical plasma column, producing such azimuthal spirals. More high resolution imaging can shed light on the nature of these instabilities.

In this project, we would work on detailed camera data analysis to identify the filamentary structures, investigate the nature of the spiral arms, understand spatiotemporal patterns and finally use statistical methods to characterize these filamentary structures. The imaging techniques and the data analysis tools that the students will learn should be useful in any other imaging related studies. In that sense, the pedagogical aspects of this project will go beyond understanding of plasma physics phenomena, and should be applicable to any other imaging based data sets, such as satellite images of cyclonic weather patterns or cell phone videos of milk being added to a cup of coffee (both are examples of vertical structures, being observed from the top). On the side, we shall learn about instabilities and turbulence phenomena.

Disciplines:
Physics, Mathematics, Engineering

Is U.S. citizenship required to participate in this project?
Yes

Internship Location and COVID-19 related Backup Plan
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:
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Internship Coordinator/ HR manager:
Edward Thomas (etjr@auburn.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.