Laboratory studies of waves in magnetized plasmas and magnetized dusty plasmas

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The study of waves and instabilities is one of the most fundamental research activities in both naturally-occuring and laboratory plasma environments. Because environments ranging from the solar system to planetary nebulae are dynamic, magnetized plasma environments, for many decades researchers have developed a wide variety of laboratory devices that, when properly scaled to the relevant dimensionless parameters, can provide detailed insights into phenomena in space. For over a decade, the Plasma Sciences Laboratory (PSL) at Auburn University has performed fundamental investigations of a variety of wave phenomena in magnetized plasmas. This presentation provides a brief overview of our ongoing and planned research activities in this area.

The first part of this talk will review measurements that are being performed in the ALEXIS (Auburn Linear EXperiment for Instability Studies) device. ALEXIS is a 170 cm long, 10 cm diameter magnetized plasma column. Recent investigations have focused on using a dual plasma source configuration to establish highly spatially localized electric fields in the plasma that have a scale length less than the ion gyroradius. It will be shown that instabilities in the lower hybrid range of frequencies can be generated in these plasmas.

The second part of this talk will focus on measurements of waves and instabilities in the Magnetized Dusty Plasma Experiment (MDPX) device. MDPX, which is currently under construction, is designed to be a novel, high magnetic field ($B_{max} \geq 4$ T) experiment that will study the properties of plasmas in which the dynamics of all of the charged components, the electrons, ions, and charged microparticles, are dominated by magnetic forces. This presentation will discuss planned measurements of dusty plasma waves, notably the electrostatic dust cyclotron wave, in the MDPX device.