Studies of dust particle confinement and transport in strongly magnetized plasmas using the Magnetized Dusty Plasma Experiment (MDPX) device

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For over a decade, it has been postulated that the addition of a magnetic field can have a profound influence on the properties of a complex/dusty plasma. A number of experimental devices have been built around the world to explore the physics of dusty plasmas in strongly magnetized plasmas. Just over two years ago, the Magnetized Dusty Plasma Experiment (MDPX) device at Auburn University became the latest facility commissioned to study dusty plasmas in strongly magnetized plasmas. The MDPX device is a flexible, high magnetic field research instrument with a mission to serve as an open access, multi-user facility for the dusty plasma and basic plasma research communities. In a strong magnetic field, the transport of ions and electrons in the plasma will be modified. This changes how the microparticles become charged and modifies the Debye screening of the microparticles by the surrounding plasma, thus altering the inter-particle interactions within the plasma. In particular, under conditions when the magnetic field is sufficiently large, $B \geq 2.5$ T, a variety of emergent phenomena are observed including a new type of imposed spatial ordering, significantly modified particle charging, and a strong coupling between ion and microparticle transport. This presentation will focus on two recent studies in the MDPX device that make use of these changes in the properties of the dusty plasma. First, we will discuss measurements of the deflection of a falling particle through the plasma when $\boldsymbol{g}$ and $\boldsymbol{B}$ are perpendicular. Specifically, we will use a measurement of the $\underline{\boldsymbol{g}} \times \underline{\boldsymbol{B}}$ drift to determine the grain charge in the bulk plasma. In a second measurement, we will describe a new experimental configuration for studying the formation of probe-induced voids in magnetic fields.