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Summary of initial results from the Magnetized Dusty Plasma Experiment (MDPX) device[1]

EDWARD THOMAS, Auburn University

Dusty (or complex) plasmas are four-component plasma systems consisting of electrons, ions, neutral atoms and charged, solid particulates. These particulates, i.e., the "dust," become charged through interactions with the surrounding plasma particles and are therefore fully coupled to the background. The study of dusty plasmas began with astrophysical studies and has developed into a distinct area of plasma science with contributions to industrial, space, and fundamental plasma science. However, the vast majority of the laboratory studies are performed without the presence of a magnetic field. This is because, compared to the masses of the electrons and ions, the dust particles are significantly more massive and therefore the charge-to-mass ratio of the dust is very small. As a result, large (B $>$ 1 T) magnetic fields are required to achieve conditions in which the dynamics of electrons, ions, and dust particles are dominated by the magnetic field. This presentation will provide a brief description of the design of the large bore (50 cm diameter x 158 cm long), multi-configuration, 4-Tesla class, superconducting magnet and integrated plasma chamber optimized for the study of dusty plasmas at high magnetic field - the MDPX device [1]. The presentation will then focus on initial results of measurements made using MDPX - including observations of a new type of imposed ordered structures formed by the dust particles in a magnetized plasma [2], E x B driven flows of the particles, and observations of instabilities. This work is a collaboration of the author with Uwe Konopka (Auburn), Robert L. Merlino (Univ. of Iowa), Marlene Rosenberg (UCSD), and the MDPX team at Auburn University.

[1] E. Thomas, et. al, J. Plasma Phys., 81, 345810206 (2015).
[2] E. Thomas Jr, Phys. Plasmas, 22, 030701 (2015).

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