Using high magnetic fields to explore the properties of plasmas and complex plasmas

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In the presence of the magnetic field, an evolution in the properties of the plasma and complex plasma should occur as the dynamics of first the electrons, then the ions, and finally the charged microparticles become dominated by the magnetic field. In particular, many of the fundamental properties of a complex plasma, e.g., particle charging, formation of two- and three-dimensional structures, and the dispersion of waves, etc., will be modified. Because of the opportunities presented by this new experimental regime, over the last decade, there has been increasing interest in the study of complex (dusty) plasmas in the presence of magnetic fields. Around the world, several devices capable of producing the high magnetic fields (B $>$ 1 Tesla) that are necessary to achieve the conditions under which all of the charged species in a complex plasma are magnetized have come into operation.

The most recent of these devices, the Magnetized Dusty Plasma Experiment (MDPX) device is a large bore (50 cm diameter x 158 cm long), multi-configuration, 4-Tesla class, superconducting magnet and integrated plasma chamber that has been operating at Auburn University since April, 2014. While the MDPX device has been initially optimized for the study of complex plasmas, it also provides a flexible, multi-user research platform that can be used for a wide variety of studies of fundamental plasma parameters and plasma stability in the presence of high magnetic fields. This presentation will discuss initial observations from the MDPX device with an emphasis on the formation of filamentary structures in the plasmas and imposed, two-dimensional structures in complex plasmas.

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