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Observation of a magnetically enabled instability in the Princeton MRI Experiment A.H. ROACH, E.J. SPENCE, C. GISSINGER, E.M. EDLUND, P. SLOBODA, H. JI, Princeton Plasma Physics Laboratory, Princeton University — The Princeton MRI Experiment is a modified Taylor-Couette device with a GaInSn working fluid used for the study of rotating MHD flows. An Ultrasound Doppler Velocimetry (UDV) system is used to measure the velocity field. It has revealed an instability causing large-amplitude velocity fluctuations when an axial magnetic field is applied to both hydrodynamically stable and hydrodynamically unstable background flow states with the split axial endcaps rotating differentially. The azimuthal velocity has a characteristic spiral mode structure at saturation, with an azimuthal mode number m=1. This instability appears in a region of parameter space distinct from that where the magnetorotational instability is expected to be present. Nonlinear 3D simulations have shown an instability of the Shercliff layer that forms at the split endcaps when a magnetic field is applied, and the resultant azimuthal flow patterns are largely consistent with experimental observations. Work is ongoing to measure the Shercliff layer in the experiment, and to identify the precise mechanism for the instability in the simulations. Results from experiments and simulations will be presented. Supported by DOE contract DE-AC02-09CH11466.

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