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**Identification of a novel non-axisymmetric mode in the Princeton Magnetorotational Instability Experiment**[1] YIN WANG, KYLE CASPARY, FATIMA EBRAHIMI, ERIK GILSON, HANTAO JI, Princeton Plasma Physics Laboratory, JEREMY GOODMAN, HIMAWAN WINARTO, Princeton University — We report a new kind of magneto-hydrodynamic (MHD) instability in a modified Taylor-Couette experiment using Galinstan as the working fluid. In the experiment, the inner cylinder, outer cylinder and upper (lower) endcaps corotate independently at a fixed angular speed ratio of $W_1$:$W_2$:$W_3$ =1:0.19:0.58. A uniform magnetic field $B_z$ is applied along the central axis. Using high-precision Hall probes installed at the inner cylinder surface, we obtain the radial magnetic field $B_r$ at various azimuths and the new MHD instability is identified from its time series. The new instability is non-axisymmetric having an azimuthal mode number $m$ =1 and a moderate frequency between $W_1$-$W_3$ and $W_1$-$W_2$. It only exists at sufficiently large $W_1$ and moderate $B_z$, consistent with typical requirements for the magnetorotational instability (MRI), and detailed quantitative comparisons are underway with theoretical analysis and numerical simulations. Further analysis shows it is not the Rayleigh instability or the Shercliff layer instability. Our results therefore shed light on the direction for finding a non-axisymmetric MRI.

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