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Radial Magnetic Field Measurements in the Princeton Magneorotational Instability Experiment to Detect the MRI[1] Y. WANG, K. J. CASPARY, F. EBRAHIMI, E. P. GILSON, PPPL, J. GOODMAN, Princeton Univ., H. JI, PPPL/Princeton Univ., H. WINARTO, Princeton Univ. — Simultaneous, time-resolved, radial magnetic field measurements at various locations along the inner cylinder of the liquid-gallinstan-filled Princeton MRI apparatus have been carried out in order to detect and characterize the MRI instability in a magnetized shear flow that is otherwise hydrodynamically stable. The MRI-induced B_r of the fastest-growing-mode is expected to be low k_z and $m = 0$ in contrast to the B_r induced by Rayleigh centrifugal modes that can occur when the local shear parameter $q = -\partial \ln r/\partial r$ exceeds 2 due to shear induced by line-tying of B_z to the conducting axial boundaries. Experimental results show the changing character of B_r as the rotation of the system, Ω, and B_z are varied. The measurements are in only rough agreement with the expected MRI stability boundary from the linear WKB analysis, and so the results are compared with results from the SFEMaNS code which includes realistic material properties and boundary conditions. Over a broad range of parameters, both MRI and Rayleigh likely contribute to B_r (as well as possibly magnetized Ekman flow) and so additional analyses using a global eigenmode code were carried out to artificially vary B_z in order to disentangle the various contributions to B_r.

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Erik Gilson
Princeton Plasma Physics Laboratory

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