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Magneto-convective Heat Transfer Measurements in Liquid Gallium YUFAN XU, University of California, Los Angeles, SUSANNE HORN, Coventry University, JONATHAN AURNOU, University of California, Los Angeles — We conduct heat transfer measurement of a liquid gallium Rayleigh-Bénard system with a vertical magnetic field. The experiment is carried out in two cylindrical containers with diameter-to-height aspect ratio $\Gamma = 1$ and 2 for $10^6 < Ra < 10^8$ and $0 < Ch < 3 \times 10^5$. Combined the results from the previous studies, our experiment shows a more complete picture of near-onset to supercritical behaviors of heat transfer in liquid metal magnetoconvection (MC) over a large range of parameter space ($10^3 < Ra < 10^9$). Moreover, we tested different critical Ra predictions from Chandrasekhar(1961), Busse(2008), and Houchens et al.(2002). Our study shows that convection onsets below the predicted critical Ra for an infinite fluid layer (Chandrasekhar, 1961) and MC in our finite cylindrical tanks onsets via stationary wall-attached modes. This result is in agreement with recent experiment (Zürner et al., 2020) where the wall-mode was found experimentally near onset. The heat transfer data also suggest that asymptotic critical Ra from Busse(2008) is likely the best to describes the onset of magnetoconvection in a cylindrical confinement regardless of the different aspect ratios.

Yufan Xu
University of California, Los Angeles

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