Abstract Submitted
for the DFD16 Meeting of
The American Physical Society

Magnetostrophic Rotating Magnetoconvection[1] ERIC KING, Nike Sustainable Innovation , JONATHAN AURNOU, UCLA Earth and Space Sciences — Planetary magnetic fields are generated by turbulent convection within their vast interior liquid metal cores. Although direct observation is not possible, this liquid metal circulation is thought to be dominated by the controlling influences of Coriolis and Lorentz forces. Theory famously predicts that local-scale convection naturally settles into the so-called magnetostrophic state, where the Coriolis and Lorentz forces partially cancel, and convection is optimally efficient. To date, no laboratory experiments have reached the magnetostrophic regime in turbulent liquid metal convection. Furthermore, computational dynamo simulations have as yet failed to produce a globally magnetostrophic dynamo, which has led some to question the existence of the magnetostrophic state. Here, we present results from the first turbulent magnetostrophic rotating magnetoconvection experiments using the liquid metal gallium. We find that turbulent convection in the magnetostrophic regime is, in fact, maximally efficient. The experimental results clarify these previously disparate results, suggesting that the fluid dynamics saturate in magnetostrophic balance within turbulent liquid metal, planetary cores.

[1]The authors thank the NSF Geophysics Program for financial support.

Jonathan Aurnou
UCLA Earth and Space Sciences

Date submitted: 01 Aug 2016 Electronic form version 1.4