Precession-driven dynamos in a full sphere and the role of large scale cyclonic vortices

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Precession has been proposed as an alternative power source for planetary dynamos. Previous hydrodynamic simulations suggested that precession can generate very complex flows in planetary liquid cores [Lin et. al., Physics of Fluids 27, 046601 (2015)]. In the present study, we numerically investigate the magnetohydrodynamics of a precessing sphere. We show that precession can drive dynamos in different flow regimes, laminar and turbulent. In particular, we highlight the role played by large scale cyclonic vortices in the magnetic field generation, which has not been explored previously. In this regime, dynamos can be sustained at relatively low Ekman and magnetic Prandtl numbers, which paves the way for planetary applications.
