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Observations of inertial waves in spherical Couette flow DOUGLAS H. KELLEY, SANTIAGO ANDRES TRIANA, DANIEL S. ZIMMERMAN, BARBARA BRAWN, DANIEL P. LATHROP, DONALD H. MARTIN, University of Maryland — Dynamo action in the cores of planets and stars gives rise to their magnetic fields. We explore spherical Couette flows in liquid sodium as a laboratory model of the Earth's core. Our apparatus is comprised of two independently driven rotating spheres, radii 20 and 60 cm, with sodium filling the gap between them. We apply an axial magnetic field from external magnets and image the resulting induced magnetic field. For small Lundquist number $S \equiv B_0 l/\sqrt{\eta^2 \rho \mu_0}$ (where l is a characteristic length scale, η is the magnetic diffusivity, and ρ is the density), the magnetic field is a passive probe of the internal flows. Data from a collection of Hall probes arrayed along a meridian and along the equator are used to characterize the induced magnetic field outside the outer sphere. Images of the field show patterns consistent with Coriolis-restored inertial modes. Moreover the frequencies and symmetries of the observed field are in good agreement with theoretical calculations of inertial modes in a sphere. Our results have implications for the geophysical behavior of Earth's core as well as other rotating fluid systems.

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