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Dynamics in the Ball: Surprising Single-Hemisphere Dynamos in Fully Convective M-dwarf Simulations[1] BENJAMIN BROWN, University of Colorado, Boulder, JEFFREY OISHI, Bates College, GEOFFREY VASIL, University of Sydney, DANIEL LECOANET, Northwestern University, KEATON BURNS, Massachusetts Institute of Technology — M-dwarf stars are smaller and less luminous than our Sun; unlike our Sun, M-dwarf stars below a certain mass are convective from their cores to their photospheres. These fully convective objects are extremely numerous, very magnetically active, and the likely hosts of many exoplanets. This ball-like interior geometry is unique among all the stars on the main-sequence, and studying dynamics in the ball requires new computational techniques. Here we study, for the first time, dynamo action in simulations of stratified, rotating fully convective M-dwarf stars. We do this using the novel spherical Dedalus pseudospectral framework to capture the coordinate singularity at the center ($r = 0$), as well as the north and south pole. We find that surprising single-hemisphere dynamo states are achieved, with most of the global-scale fields located in a single (northern or southern) hemisphere. These dynamos undergo cyclic reversals and exist over a broad range of the parameter space studied so far.

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