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Dynamics in the Ball: Models for Fully Convective, Rotating M-Dwarf Stars BENJAMIN BROWN, University of Colorado, JEFFREY OISHI, Bates College, DANIEL LECOANET, Princeton University, KEATON BURNS, Massachusetts Institute of Technology, GEOFFREY VASIL, University of Sydney
— M-dwarf stars are smaller and less luminous than our Sun. In their interiors, convection dominates energy transport from the center of the star to their surface. This ball-like geometry is unique among all the stars on the main-sequence; in our Sun, solar convection is bounded from below by regions of stable stratification, creating a shell-like geometry instead. Within stellar convection zones, the turbulent plasma motions act as a dynamo, stretching and amplifying magnetic fields. M-dwarf stars have abundant and strong magnetic fields at their surfaces, but at a fundamental level we do not know whether these ball-like stars are similar to or different from our shell-like Sun. Here, using the novel spherical Dedalus pseudospectral framework, we consider the properties of convection and magnetic dynamo action in rotating, stratified simulations within global ball domains that capture the coordinate singularity at the center ($r = 0$), as well as the north and south pole. We find that global shearing flows are built by the convection, and these amplify global magnetic fields. Many ingredients in the fully convective M-dwarf simulations are similar to those found in simulations of the solar dynamo; this implies that these dissimilar stars may have similar internal processes.

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