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The Elbert Subrange of Magnetostrophic Rotating Magnetoconvection SUSANNE HORN, Coventry University, JONATHAN AURNOU, University of California, Los Angeles — Classical linear stability analysis shows that convection subjected to rotation and a magnetic field is most easily excited when Coriolis and Lorentz forces are approximately in balance and in the form of a large-scale stationary bulk mode. Since estimates for Earth also suggest that the outer liquid metal core is in this so-called magnetostrophic state, there is a long-held belief that these modes optimise planetary magnetic field generation. But a single-mode theory is not likely to be geophysically realistic. Instead, liquid metal flows are characterised by pronounced multimodality with a mix of stationary, oscillatory, and boundary-attached modes. In fact, Donna Elbert (cf. Chandrasekhar, 1961) discovered that there is subrange of magnetostrophic rotating magnetoconvection where two types of stationary modes co-exist: a small-scale geostrophic mode and a large-scale magnetostrophic mode. The parameter space for this subrange coincides with the one for planetary cores, suggesting a crucial link to the magnetic field generation in geo- and astrophysical objects. Here, we revisit linear stability results and further use nonlinear direct numerical simulations to verify which onset characteristics, such as length scales and frequencies, carry over to higher supercriticalities.

Susanne Horn
Coventry University

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