A jet-like structure revealed by a numerical simulation of rotating spherical shell magnetoconvection

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A numerical result of thermally driven nonlinear magnetoconvection in a rapidly rotating fluid spherical shell is reported. A uniform magnetic field parallel to the rotation axis is externally imposed. The Ekman number is 2.0e-6, well representing a state of negligible viscosity like in the Earth's core. The convection pattern is characterized by a fast westward zonal flow plus a few large-scale vortex columns. In the equatorial region an anticyclonic vortex is intensified which stores an axial magnetic field induced inside. An interaction between the magnetized vortex and the zonal flow forms a thin jet at the western front of the vortex. The jet is also characterized by a thin electric current sheet parallel or antiparallel to the flow. A jet estimated in the case of the Earth's core might be typically of width 15 km and of speed more than 1 cm/s.