

MHD Dynamo by Polyhedral Convections

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We performed magnetohydrodynamic (MHD) simulations of dynamo in a rotating spherical shell under the conditions with low Rayleigh number and low rotation rate Ω . It is known that convections in these cases are organized as polyhedral cells. Computations were done with newly developed spherical grid system called Yin-Yang-Zhong grid [Hayashi & Kageyama, JCP, 2016]. The aspect ratio of radii of the inner sphere and the outer sphere is 0.7. It was found that: (1) In the low Ω limit, basic structures of the convection are (as expected) tetrahedron or hexahedron. (2) These convection structures are robust for larger Ω . (3) Magnetic field grows for $\Omega > 0$ on both the tetrahedron and the hexahedron convections. (4) For $\Omega > 0$, down flows in the vertices of the polyhedra have spiral paths, and dynamo takes place there. (5) The dynamo disappears when Ω is increased more.

Keywords: MHD dynamo, spherical shell, Yin-Yang-Zhong grid