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Scaling laws for planetary convection and magnetism

Sergey Starchenko
IZMIRAN, Troitsk, Moscow obl., Russian Federation (sstarchenko@mail.ru, 7496 7510124)

The known scaling laws have already been derived from the available planetary convection and magnetic dynamo simulations. Perhaps for the first time I prove those laws from the first principles in order to show that the correspondent simulations are in the regime with kinetic energy exceeding or comparable with magnetic energy. This kinetic regime leads to relatively lower dynamo efficiency, asymmetric and non-stable magnetic field similar to magnetic field of the Mercury, Uranus and Neptune. As well from the first principles I found the other true magnetic regime that could hardly be reached by the present day numerical simulations. This magnetic regime has efficient magnetic dynamo energy exceeding kinetic energy. Its symmetric and stable magnetic field is similar to magnetic field of the Earth, Jupiter and Saturn. The particular planet kinetic or magnetic regime is first depending on its thermal/compositional power flows, conductivity and rotation, while the other parameters are less important. So, we could reconstruct the global thermal/compositional evolution of the deep planetary interior combining the available planetary magnetic field data with the new high pressure experiments and theory for the state of the deep planetary interior.

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