MAGNETIC FIELD GENERATION IN THE PRESENCE OF DOUBLE DIFFUSIVE CONVECTION IN PARTLY STABLE CORE OF MERCURY

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Some recent dynamo models for Mercury assume that the top part of the fluid core is stably stratified because of a sub-adiabatic temperature gradient at the core-mantle boundary. In these models, the dynamo is maintained by the vigorous convection in the deep parts of the core. These models have been successful in producing the observed weak large-scale magnetic field at the surface of the planet. However, they have been based on the concept of co-density, which combines the buoyancy effects of temperature and composition into a single variable and assumes equal diffusivities for the both components. To overcome this limitation, we have solved two separate transport equations to model the evolution of temperature and light constituents in the outer core. To analyse the potential effects of double diffusive convection (DDC) on Mercury's dynamo we have explored a model where the two diffusivities differ by an order of magnitude and the outer core is partly stable. The results, computed for an Ekman number of 3.0×10^{-4} and 2 wght% sulphur concentration, show a significant difference in the nature and amplitude of the magnetic fields between the DDC and co-density models. For the DDC case, we find a strong toroidal magnetic field within the stably stratified layer of the core fluid which is missing in the co-density model. Also, magnetic field at the planetary surface is about two orders of magnitude stronger in the more realistic DDC model compared to the co-density model. A weak surface magnetic field, similar to that observed at Mercury, is produced in DDC models for a very small fraction of light constituents (< 0.2 wght%). These results imply that the core of Mercury may be poor in sulphur and other light constituents

Double diffusive convection, dynamo, Mercury, magnetic field

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