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Hydromagnetic instabilities in polar regions of the Earth's core influenced by anisotropic diffusive coefficients

T. Soltis (1) and **J. Brestensky** (1)

(1) Dept. of Astronomy, Physics of the Earth and Meteorology, Faculty of Mathematics, Physics and Informatics, Comenius University, Bratislava, Slovakia, (brestensky@fmph.uniba.sk)

Investigating our models of rotating magnetoconvection we try to indicate why geodynamo simulations with not too realistic parameters (e.g. Ekman number) are so succesfull using artificially defined diffusive coefficients.

Hydromagnetic instabilities are studied in Cartesian geometry in the stratified horizontal fluid planar layer uniformly rotating about vertical axis. Both stationary convection and overstability are studied. The layer is permeated by homogeneous horizontal magnetic field. We consider three basic cases of anisotropic diffusive coefficients (thermal diffusivity and viscosity) – anisotropies of SO, SA and BM type. In the first two cases (SO, SA) the diffusive coefficients are horizontally isotropic but their horizontal values are distinct from the vertical value. In the SO type, i.e. in the anisotropy of ocean type the diffusivities are greater in the horizontal direction than in vertical one, while in the anisotropy of atmospheric (SA) type the vertical diffusivities are the greater. The SO, and SA anisotropies we call the stratification anisotropies .The BM anisotropy is the anisotropy of Braginsky and Meytlis (1990) in which the eddy diffusivities are greater in the direction of magnetic field (in one horizontal direction) and in the direction of vertical rotation axis than in the 2nd horizontal direction. There are many various reasons to prefer in some states of some regions of the Earth's core the anisotropic case SO or SA or BM. Therefore, we compare all types of diffusive coefficients anisotropies in their role to facilitate or inhibit the onset of rotating mag-

netoconvection and how they influence the properties of arising instabilities. The case of isotropic diffusive coefficients is also studied and compared with all anisotropic cases.

In the cases of most probable anisotropy in the Earth's core, i.e. for anisotropic diffusive coefficients of Braginsky-Meytlis type the nonstationary convection is less possible than the stationary convection, because the range of parameters (Elsasser number, Ekman number, ...) decreases by increasing anisotropy of diffusive coefficients.