R004-P01
ポスター 4 ：11/26　AM1/AM2 （9:00-12:00）

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Effects of symmetric-antisymmetric interaction on the planetary magnetic fields

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Planetary magnetic fields as well as the geomagnetic field have diversity in their morphology. Apparently asymmetric structure with respect to the equator is obvious in the fields of the Earth, Mercury, Jupiter, and so on. Such an asymmetric morphology is a result of composites of the symmetric and anti-symmetric components. The anti-symmetric field is referred to as the dipole family component, while the symmetric field is to the quadrupole family component. The axial dipole field is a typical anti-symmetric component, while the axial quadrupole is a symmetric component. Theoretically, the magnetic field of different family is decoupled, if and only if the velocity field consists solely of the equatorially symmetric component, which is supposed to be the dominant component in the Earth's core. Thus, generation processes of the dipole/quadrupole family field and its reaction to the velocity can independently be examined by suitably choosing a velocity field even in non-linear MHD (Magneto-Hydro Dynamic) models. It is well known that slight deviation in the velocity field from the equatorial symmetry by superimposing the anti-symmetric flow often results in a substantially asymmetric magnetic field like Mercury's dynamo due to non-linear coupling between the velocity and magnetic fields (Takahashi et al. 2019).

Here, we use numerical dynamo modeling to examine non-linear coupling processes between the dipole and quadrupole families. Dynamo simulations are run at the fixed parameters, where different initial conditions are used. Initial perturbations for the buoyancy are designed to drive either purely symmetric convection or asymmetric convection. We investigate behavior of the dynamo solution by varying the Rayleigh number. As a result, in some cases, substantially different dynamo solutions are obtained even at the same parameter values due to advent of non-linear coupling. In this presentation, results of our preliminary analysis for dynamos on kinetic and magnetic energy, spectra, and their dependence on the Rayleigh number will be shown and discussed.

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