U054-050 **Room: Ocean B** **Time: May 16 11:55-12:15**

Dipolar and non-dipolar dynamos in a thin shell geometry

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Dynamo action working in a thin spherical shell geometry is examined using three-dimensional numerical models. Focused are behavior of the geodynamo in the future, and the planetary dynamos with the large inner core like Mercury. Convection is powered by either thermal or compositional buoyancy. In case of thermal convection, temperature difference between the inner and outer boundaries drives convection. On the other hand, compositional convection is driven by the release of the light elements contained in the fluid outer core at the inner core boundary due to inner core growth. Dipolar dynamos are obtained in the regime of columnar flows outside the tangent cylinder, whereas non-dipolar dynamos dominated by the multipole components are found in the regime of flows both inside and outside the tangent cylinder. It turns out that columnar-like convective motions not only outside but also inside the tangent cylinder are responsible for the non-dipolar dynamo. The electrically conducting inner core enhances the strength of large-scale magnetic field, but predominance of the non-dipolar components remains due to the thin shell geometry. These results suggest that the magnetic field generated in a thin shell geometry, such as Hermean dynamo and the geodynamo in the future, may have complicated structure.