TAYLOR STATES AND THE DYNAMICAL INFLUENCE OF THE INNER CORE.

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The Earth's magnetic field is currently generated in the liquid outer core by convective flows, powered by the release of buoyant material at the boundary of the inner core. However, the age of the inner core is a subject of controversy and it is possible that the geodynamo operated long before it came into existence. On a dynamical level, the inner core has a fundamental impact on the form of the convection splitting the outer core into two regions, separated by the so-called tangent cylinder. It is therefore of interest to characterize the influence of the inner core, if any, on the structure of the geodynamo, particularly as current inverse methods cannot probe the structure of the geomagnetic field inside the core.

In this work, we exploit the fact that, in the fluid core, the magnetic field satisfies a condition termed Taylor's constraint. By explicitly constructing several examples, we compare plausible models of the field either with or without an inner core. Here, the influence of the inner core has a significant impact on the structure of Taylor's constraint, vastly increasing its potency. We discuss what fundamental changes in the permissible morphology of the magnetic fields could arise in the geodynamo before and after the formation of the inner core.

Taylor's constraint; Taylor states; inner core; tangent cylinder

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