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Angular Momentum Transport in the Earth's Core BRUCE BUFFETT, University of Chicago — Convection in the Earth's liquid iron core continually regenerates the geomagnetic field and sustains a differential rotation between the inner and outer boundaries. The differential rotation is thought to be a consequence of large-scale fluid circulation in a region defined by the tangent cylinder (a hypothetical cylinder that is tangent to the solid inner core at the equator). Magnetic stresses sweep the solid inner core in the direction of the overlying flow. An additional complication arises due to gravitational interactions between the solid inner core and the rocky outer region, known as the mantle. A heterogeneous distribution of mass in the inner core and mantle can yield a surprisingly large gravitational force when the inner core rotates away from its equilibrium alignment with the mantle. This restoring force is sufficient to oppose the magnetic stresses that drive inner-core rotation. However, the inner core can escape the lock of gravity by plastically deforming as it rotates. Numerical dynamo models that include the influences of gravitational coupling and plastic deformation suggest that the differential rotation is limited by the rate of deformation of the inner core. The calculations also predict large fluctuations in the rate of differential rotation. Any angular misalignment between the inner core and mantle transfers angular momentum to the mantle, which can be detected as a change in the length of day. The fluctuations in inner-core rotation also excite waves that transmit angular momentum through the liquid core.

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