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The geomagnetic westward drift and Earth's inner core dynamics

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Since its initial observation by Halley more than 300 years ago, the geomagnetic westward drift has been documented with increasing accuracy. The picture prevailing at present is that of core-mantle boundary equatorial magnetic flux patches of normal polarity appearing to steadily drift westwards during the last 400 years. Recently we have put forward numerical geodynamo models reproducing this peculiar magnetic field pattern and explaining the geomagnetic westward drift through indirect angular momentum exchanges between the outer core and mantle. These indirect exchanges occur via the inner core, which is magnetically coupled to the base of the outer core and gravitationally coupled to the mantle. Our models naturally highlight the fact that the long-term westward drift and the long-term super-rotation of the inner core respectively to the mantle are two components of Earth's rotational dynamics, and are thus linked together as such. In this presentation we will explore the nature of this link and show that the total amount of shear present in the core is distributed among these two components in accordance with the relative magnitude of indirect core-mantle coupling versus direct coupling at the core-mantle boundary. An application of this theory using reasonable and up-to-date values for geophysical parameters suggests that the long-term westward drift dominates the long-term inner core super-rotation at present by about an order of magnitude.