



Earth's Core Has Stopped and May Be Reversing Direction, Study Says

The surprising finding might solve longstanding mysteries about climate and geological phenomena.



By [Becky Ferreira](#)

January 23, 2023, 8:22am   

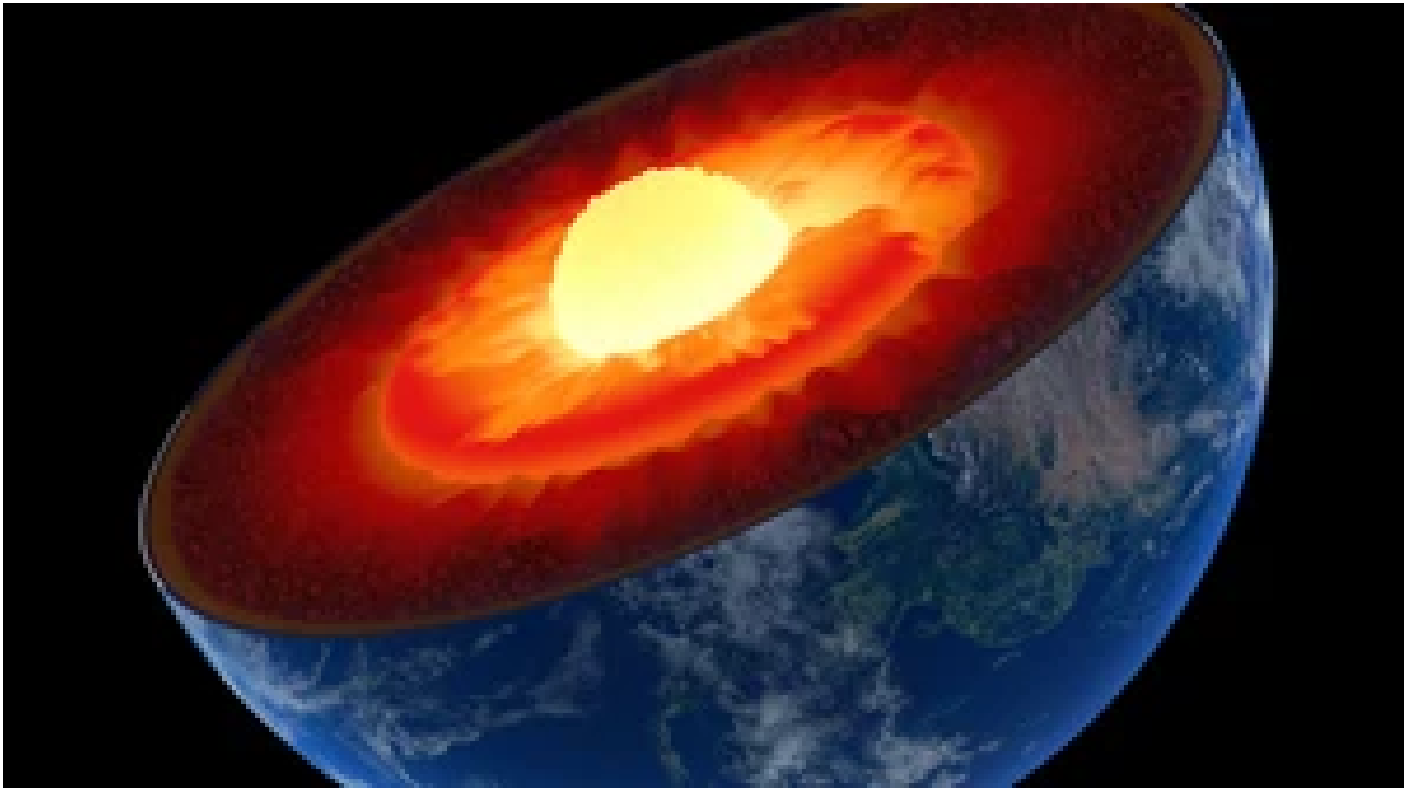


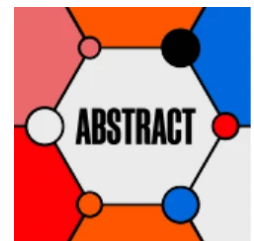
IMAGE: ARGONNE NATIONAL LABORATORY/FLICKR

CC BY-NC-SA 2.0

Earth's inner core has recently stopped spinning, and may now be reversing the direction of its rotation, according to a surprising new study that probed the deepest reaches of our planet with seismic waves from earthquakes.

The mind-boggling results suggest that Earth's center pauses and reverses direction on a periodic cycle lasting about 60 to 70 years, a discovery that might solve longstanding mysteries about climate and geological phenomena that occur on a similar timeframe, and that affect life on our planet.

Of course, it must be noted this is more or less the plot of the 2003 disaster film *The Core*, but there's no need to worry about averting an impending apocalypse by nuking the center of Earth. While the core's rotation influences Earth's surface environment,



ABSTRACT
breaks down
mind-bending
scientific research,

scientists think this periodic spin switch is a normal part of its behavior that does not pose risks for life on our planet.

Earth's inner core is a solid metal ball that is 75 percent the size of the Moon. It can spin at different speeds and directions compared to our planet because it is nestled within a liquid outer core, but scientists are not sure exactly how fast it spins or whether its speed varies over time.

future tech, new discoveries, and major breakthroughs.

SEE MORE →

Located some 3,000 miles beneath our feet, the core experiences intense heat on par with the surface of the Sun. Because it is so remote and difficult to study, the inner core remains one of the least understood environments on our planet, though it's clear that it plays a role in many processes that make our world habitable to life, such as the generation of Earth's protective magnetic field, which blocks harmful radiation from reaching the surface.

Now, Yi Yang and Xiaodong Song, a pair of researchers at Peking University's SinoProbe Lab at School of Earth and Space Sciences, have captured "surprising observations that indicate the inner core has nearly ceased its rotation in the recent decade and may be experiencing a turning-back in a multidecadal oscillation, with another turning point in the early 1970s," according to [a study published on Monday](#) in *Nature Geoscience*.

"There are two major forces acting on the inner core," Yang and Song said in an email to Motherboard. "One is the electromagnetic force. The Earth's magnetic field is generated by fluid motion in the outer core. The magnetic field acting on the metallic inner core is expected to drive the inner core to rotate by electromagnetic coupling. The other is gravity force. The mantle and inner core are both highly heterogeneous, so the gravity between their structures tends to drag the inner core to the position of gravitational equilibrium, so called gravitational coupling."

"If the two forces are not balanced out, the inner core will accelerate or decelerate," they added. "Both the magnetic field and the Earth's rotation have a strong periodicity of 60-70 years. We believe that the proposed 70-year oscillation of the inner core is driven by the electromagnetic and gravitational forces."

Song has spent decades trying to unravel the mysteries of the inner core by studying seismic waves that pass through this distant region. He was part of the team that [first reported evidence](#) of the inner core's rotation in 1996 by measuring slight time (or "temporal") changes in these waves, which are generated by earthquakes.

However, the origin of the temporal changes has been a matter of debate within the geoscience community ever since, as some scientists think the wave patterns arise from phenomena at the boundary between the outer and inner core.

"Some researchers are still arguing that the temporal changes do not come from the inner-core rotation, but from localized deformation at the inner core boundary," Yang and Song said. With their new study, the pair "tried to gather more data over a longer duration to test different models."

To that end, the team studied seismic waves that passed through the inner core made by earthquakes that occurred since the 1960s. In particular, they looked for "doublet" events, which are "repeating earthquakes with nearly identical waveforms at common receivers," according to the study. By analyzing the slight temporal changes between these doublets, Yang and Song were able to probe the rotation of the inner core.

As it turned out, the temporal changes reached a minimum around 2009, suggesting that the inner core had paused rotation around this time, creating seismic observations that seem more static. The team was even more astonished

when they identified a similar turning point in the early 1970s, hinting that the core stops and reverses rotation on a periodic cycle.

“Our results further support the inner-core rotation, and more interestingly, reveals the multidecadal pattern of the rotation,” Yang and Song said to Motherboard.

The results offer an unprecedented look at the searing pit of our planet, a region that continues to evade clear explanation, and it also has big implications for understanding the familiar world we inhabit on Earth’s surface.

For instance, the team notes that the same multidecade cycle has also been observed in Earth’s climate system, as global mean temperatures and sea level rises appear to oscillate every 60 to 70 years. The length of Earth’s day, which shifts slightly over time, also seems synced to the proposed cycle. For this reason, the new findings “may imply dynamic interactions between the deepest and shallowest layers of the solid Earth system,” according to the new study.

“We pointed the existence of similar periodicity of different observations, forming a

resonating system,” Yang and Song told Motherboard. “The linkage, however, is less clear at the moment. The gravitational coupling between the inner core and the mantle may cause deformation at the Earth’s surface, which would affect the sea level. The changes of the sea level and the Earth’s rotation may affect the global atmosphere circulation and temperature. The resonance of different systems may also amplify the mutual interactions.”

It’s tantalizing to imagine that our most mundane experiences—such as the length of our days, and the climatic patterns that guide our local weather—might be sculpted by the rotational cycles of a weird metal ball at the center of our world. Untangling these nuances will require new models and continued observations of Earth’s enigmatic central realm.

The next steps are “to build quantitative models of the physical mechanisms on the multi-decadal oscillation system” and “to monitor how the rotation changes in the future,” Yang and Song said.

“We’d expect it to rotate westwards relative to the surface of the Earth in the coming years and decades,” the pair concluded. “Seismic waves are still the best way and thus continuous operation of high-quality seismic networks is crucial in this regard.”