Researchers Discover Jet Stream in Earth’s Molten Iron Core

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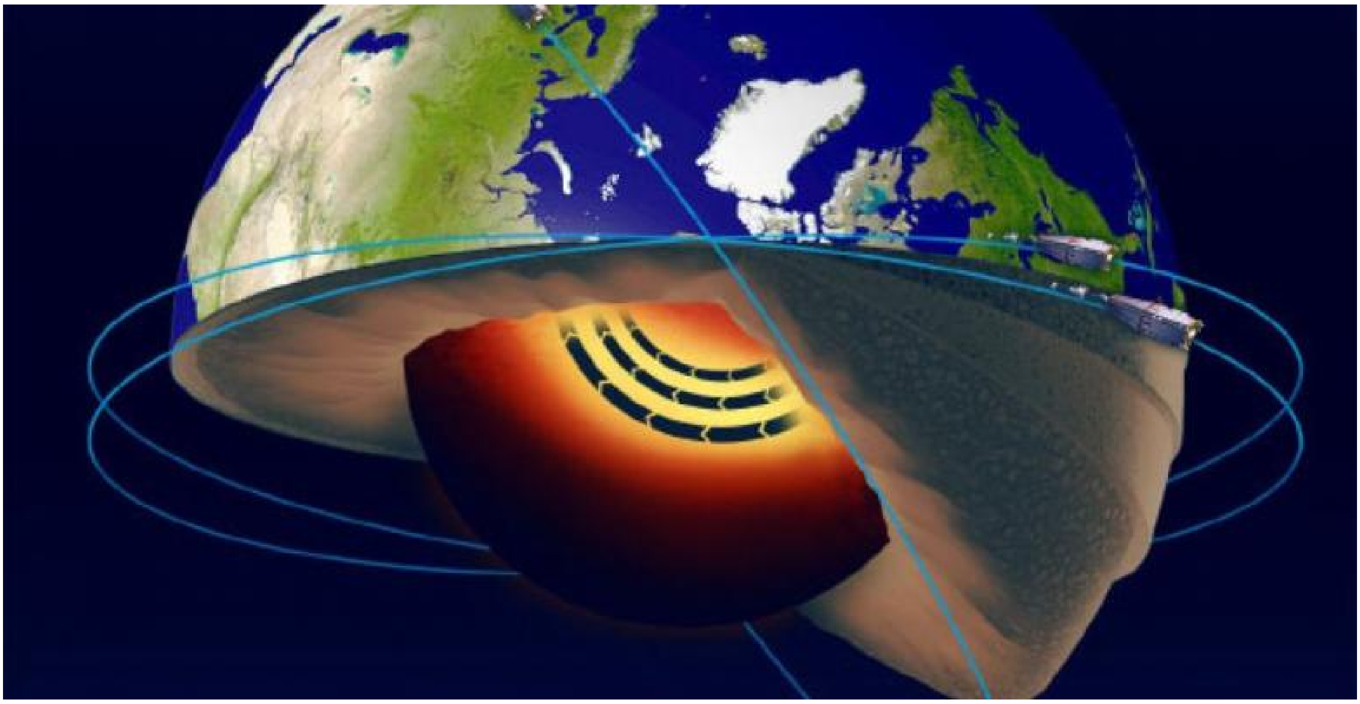

A jet stream within the Earth’s core has been discovered by researchers using data from ESA’s Swarm satellite mission.

Launched in 2013, the three Swarm satellites are measuring and untangling the different magnetic fields that stem from Earth’s core, mantle, crust, oceans, ionosphere and magnetosphere.

Together, these signals form the magnetic field that protects us from cosmic radiation and charged particles that stream towards Earth in solar winds.

The field exists because of an ocean of superheated, swirling liquid iron that makes up the outer core. Like a spinning conductor in a bicycle dynamo, this moving iron creates electrical currents, which in turn generate our continuously changing magnetic field.

Tracking changes in the magnetic field can, therefore, tell researchers how the iron in the core moves.

“We know more about the Sun than Earth’s core because the Sun is not hidden from us by about 1,870 miles (3,000 km) of rock,” noted Dr. Chris Finlay, a senior scientist in the Division of Geomagnetism at DTU Space at the Technical University of Denmark and senior author of a paper published in the journal *Nature Geoscience*.

The accurate measurements by Swarm satellites allow the different sources of magnetism to be separated, making the contribution from the core much clearer.

Previous research had found that changes in the magnetic field indicated that iron in the outer core was moving faster in the northern hemisphere, mostly under Alaska and Siberia.

But the new Swarm data have revealed these changes are actually caused by a jet stream moving at more than 25 miles (40 km) per year — three times faster than typical outer-core speeds and hundreds of thousands of times faster than Earth's tectonic plates move.

“We can explain it as acceleration in a band of core fluid circling the pole, like the jet stream in the atmosphere,” said lead author Dr. Phil Livermore, from the University of Leeds.

So, what is causing the jet stream and why is it speeding up so quickly?

The jet flows along a boundary between two different regions in the core. When material in the liquid core moves towards this boundary from both sides, the converging liquid is squeezed out sideways, forming the jet.

“Of course, you need a force to move the fluid towards the boundary. This could be provided by buoyancy, or perhaps more likely from changes in the magnetic field within the core,” said co-author Prof. Rainer Hollerbach, also from the University of Leeds.

As for what happens next, the Swarm team is watching and waiting.

“Further surprises are likely,” said ESA's Swarm mission manager Dr. Rune Floberghagen, who was not involved in the current study.

“The magnetic field is forever changing, and this could even make the jet stream switch direction.”