

Life on a Giant Magnet

Compasses point north, by following Earth's magnetic field. It's amazing when you think about it there's an invisible force, flowing out of Earth's South Pole and diving back into its north pole, pulling all compass needles to the north with it.

Even more amazing is that the magnetic field is keeping us alive right now. Without it, there would be no life on Earth. We're talking Mars.

Here's how it works: Our magnetic field is generated in Earth's core. It flows outward through the crust and surrounds Earth like a giant bubble, called the *magnetosphere*, which extends more than 400,000 miles into space. But on the side that faces the sun, solar winds squash it down to just 40,000 miles.

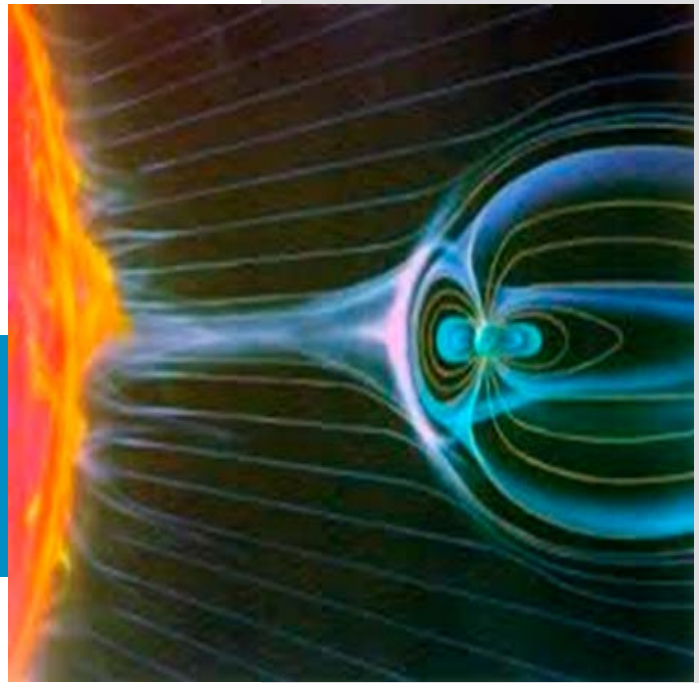
It's the force of that magnetic field, pushing back against the solar winds, that keeps them from scouring away Earth's atmosphere.

Scientists even think that, billions of years ago when Earth was forming, our magnetic field helped trap the gases that made up our atmosphere in the first place.

By contrast, when a planet loses its magnetic field, its atmosphere declines with it, like we see on Mars.

Magnetic field means atmosphere means life on Earth. That's pretty mind-blowing!

So the next time you see a compass, take a moment to remind yourself that our lives are made possible because we're living on a giant magnet.



Artist's rendition of solar wind and Earth's magnetosphere.

Credit: K. Endo, courtesy of Y. Kamida, National Geophysical Data Center.



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BACKGROUND

Synopsis: Our resilient magnetosphere safeguards the atmosphere, life on Earth, satellites, and spacecraft from solar and cosmic radiation.

- If you have ever used a compass, you know that Earth has North and South Magnetic Poles.
- Earth's core generates its magnetosphere, which is actually not sphere-shaped. It is squashed on the sun-facing side by the solar wind, extending only 40,000 mi toward the sun, while the magnetotail stretches more than 4,000,000 mi away from the sun—way beyond the moon, which is just 240,000 mi away.
- This protective magnetic field shields Earth from solar and cosmic radiation, as well as from abrasion of the atmosphere by the continuous solar wind of charged particles from the sun. By conserving the atmosphere, the magnetosphere enabled the development and continuation of life on Earth.
- The magnetic field pours out of Earth near the South Pole and dives back into Earth near the North Pole, which is why compass needles point to the north. It is invisible except when illuminated as auroras.
- Scientists believe Earth has had a magnetic field for most of its 4.4 billion yr history, enabling our planet to retain the evolving gasses that formed its early atmosphere.
- Other planets in our solar system have magnetospheres, but Earth's is the strongest of the rocky planets. In contrast, Mars has gradually lost almost its entire atmosphere as its magnetic field has slowly dissipated.
- Since many of our spacecraft and satellites reside within it, scientists study space weather within the magnetosphere because of the potential for communication disruption and adverse impact on space technology. Most of the time the magnetosphere is able to fend off electromagnetic pulses from solar flares, which would incapacitate our favorite mobile and electronic devices, not to mention damaging our frail bodies!
- The magnetosphere provides a refuge for life and electronics; we can't live our modern existence without it!

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[Earth's magnetic field | Wikipedia](#)

[Earth's Magnetosphere | NOAA Space Weather Prediction Center](#)

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Fact Sheet:

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