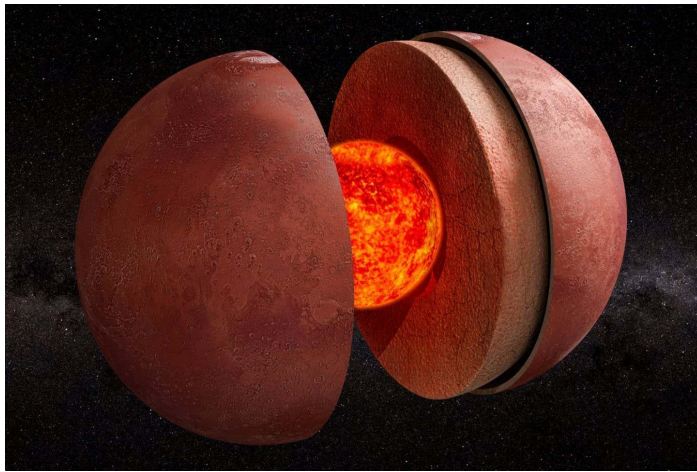


Mars may have a solid inner core like Earth does

A new analysis of marsquakes measured by NASA's InSight lander indicates Mars has a solid inner core – but other researchers say the evidence is thin

By [James Dinneen](#) on January 13, 2025



The structure of Mars's core could solve some mysteries about the Red Planet.

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Mars may have a solid inner core within its liquid outer core, according to a new analysis of the planet's seismic activity. This could help solve several enigmas about Martian geology – but not everyone is convinced.

“It’s big if true,” says [Simon Stähler](#) at ETH Zurich in Switzerland, who was not involved with the research. “The seismological evidence for it is rather thin.”

A few years ago, NASA's InSight lander gave researchers their first direct look into the interior of Mars: between 2018 and 2022, an on-board seismometer recorded the waves produced by hundreds of marsquakes reverberating within the planet. This enabled Stähler and his colleagues to identify the edge of a [large liquid core](#).

Now, [Daoyuan Sun](#) at the University of Science and Technology of China and his colleagues have also analysed the InSight data. They searched for waves that may have passed through the Martian core and then “stacked” them to amplify and identify any faint signals reflected from the planet's depths.

The researchers identified two key wave phases. One passed through the centre of Mars and back, arriving at the seismometer more rapidly than it would have if the entire core was liquid. The second phase appeared to bounce off the boundary between the liquid outer core and a solid inner core.

Both of these wave phases suggest Mars has a solid inner core with a radius of around 600 kilometres. “We looked at it twice,” says Sun. That would mean the solid centre of the core is just under a fifth of the radius of Mars itself, which is a size ratio similar to that of Earth and its solid inner core.

“I think they have a nice preliminary seismic result that will create some controversy,” says [Nicholas Schmerr](#) at the University of Maryland. “The past seismic work on the core suggests that the core was liquid but could not definitively rule out a small solid inner core. It’s not impossible.”

Stähler says he and other researchers have scrutinised all the InSight data and have not found similar signals. He also says that processing the data from seismometers different ways can produce different results – and interpreting the data correctly can involve a bit of “black magic”.

Still, Stähler was open to the possibility of an inner core. “It’s a fresh group, with a fresh view on the data,” he says. “Maybe they saw things we did not see.”

The presence of an inner core could help solve outstanding questions about the Red Planet. For instance, given Mars’s known mass, a large, entirely liquid core can only be explained if the planet was formed from more light elements than Earth was. A dense inner core solves that problem, says Stähler. “It means Mars more or less formed from the same materials as Earth.”

The finding would also raise new questions about why Mars lacks a geomagnetic field, says [David Stevenson](#) at the California Institute of Technology. On Earth, the solid inner core drives convection in the liquid outer core, which [generates the planet’s magnetic field](#). If Mars has a similar core structure, why doesn’t it have a similar field?

[Doug Hemingway](#) at the University of Texas at Austin, a co-author of the new study, says one explanation could be how the inner cores grow. On Earth, the core [freezes from the bottom up](#), which generates convection. On Mars, the inner core may form in a different way: as the outer core cools, iron crystals might “snow” down from its edge and collect at the planet’s centre.