Last Week’s Questions
3 May 2023

What are NEUTRINOS, where do they come from,
and is it true that neither snow nor rain nor heat nor gloom of night
stays these couriers from the swift completion of their appointed rounds?

Neutrinos are the most abundant particles that have mass in the universe.
Every time atomic nuclei come together (like in the sun) or break apart (like in a nuclear reactor), they produce neutrinos.
Even a banana emits neutrinos—they come from the natural radioactivity of the potassium in the fruit. (DOE)

They almost never react with other matter;
have no charge; they speed past solar photons because they're too small to be entangled in plasma;
tens of TRILLIONS of them from the Sun stream through your body every SECOND;
have no corresponding anti-particle and may be responsible for the elimination of anti-matter after the Big Bang.

For more about neutrinos produced in the Sun's core, watch:
https://neutrinos.fnal.gov/sources/solar-neutrinos/
(You gotta love the series, Even Bananas!)

Does the innermost inner core (IMIC) spin, relative to the inner core and / or the outer core?

The inner core -- a solid iron crystal whose mass is comparable to the size of the moon —

is spinning independently from the rest of the solid Earth.

It is driven by magnetic and electrical effects within the near-frictionless liquid outer core that surrounds it.

(National Science Foundation: https://new.nsf.gov/news/earths-core-spins-faster-earth)

It makes one complete revolution within the Earth every 400 years,
moving 100,000 times faster than the continents are drifting.

The IMIC probably does not move, relative to the inner core, as both are metallic solids.
It may be an anisotropic phase change in the inner core's iron.

When and How Did the Sun's T-Tauri Wind Sweep Away Earth's Primary Atmosphere?

Within 50 million years, the temperature and pressure at the core of the Sun became so great that its hydrogen began to fuse, creating an internal source of energy that countered gravitational contraction until hydrostatic equilibrium was achieved.

This marked the Sun's entry into the prime phase of its life, known as the main sequence.
Main-sequence stars derive energy from the fusion of hydrogen into helium in their cores.
The Sun remains a main-sequence star today.

T Tauri stars like the young Sun have far stronger stellar winds than more stable, older stars.
After between three and ten million years, the young Sun's solar wind would have cleared away all the gas and dust in the protoplanetary disc, blowing it into interstellar space, thus ending the growth of the planets.

Source: https://en.wikipedia.org/wiki/Formation_and_evolution_of_the_Solar_System

Another wonderful site for Solar System fans:
https://solarsystem.nasa.gov/solar-system/our-solar-system/overview/

What Causes Reversals of Earth's Magnetic Field?

One easy way to imagine the field is to think of a bar magnet that runs through Earth's center
and has a north pole and a south pole, said Merrill, who was not involved in the new WMM research.
That magnet is strong, representing roughly 75 percent of the intensity of Earth's magnetic field at the surface.
Of course, a bar magnet is not a perfect representation — it's actually electric currents that generate the Earth's magnetic field —
but the model makes it easier to imagine what's happening to Earth, Merrill added.
Specifically, the "bar magnet" is not only moving, but also getting weaker, by roughly 7 percent every 100 years.

As for the other 25 percent of the magnetic field, Merrill said that's generated from another field,
which you can picture as another moving bar magnet.
Here's an interesting bit: As the central bar magnet loses intensity, this second,
weaker magnetic field generates more influence on Earth's global magnetism.
"And that's what's causing this field to move in the direction [of Siberia]," Merrill told Live Science.

Earth's north and south poles periodically swap locations, with the last flip happening about 780,000 years ago.
(The poles also weakened temporarily and rapidly about 41,000 years ago, Beggan added, but never underwent a full flip.)
A 2018 study in the journal Proceedings of the National Academy of Sciences suggested that
Earth's magnetic field got weaker before the big changeover. (Source: https://www.space.com/43173-earth-magnetic-field-flips-when.html)

Oceans of molten iron are swirling deep inside the planet around the outer core. That sloshing sets up a giant bar magnet through Earth — though not a real concrete magnet, of course. This giant magnet sits at an angle of about 11 degrees from the axis around which Earth spins, according to Windows of the Universe. These poles are not in the same place as our geographic North and South poles.

And remember that swirling iron? It's constantly moving around. The result?
Blobs of that iron get flipped in the opposite direction from iron atoms around them; scientists say they become "reverse-aligned."
When there are enough reverse-aligned iron atoms, that giant bar magnet flips, and magnetic north becomes magnetic south.

But this bar magnet is no Olympic gymnast: The flipping isn't a quick turn but rather a gradual one,
and can take between 1,000 and 10,000 years.
"It's not a sudden flip, but a slow process, during which the field strength becomes weak, very probably the field becomes more complex and might show more than two poles for a while, and then builds up in strength and [aligns] in the opposite direction,"
Monika Korte, the scientific director of the Niemegk Geomagnetic Observatory at GFZ Potsdam in Germany, previously told Live Science.

Source: https://www.livescience.com/61603-what-if-magnetic-pole-reversal.html

Are There Transition Zones Between Earth's Inner Core, Outer Core, Mantle, and Crust?

Short Answer: Yes.

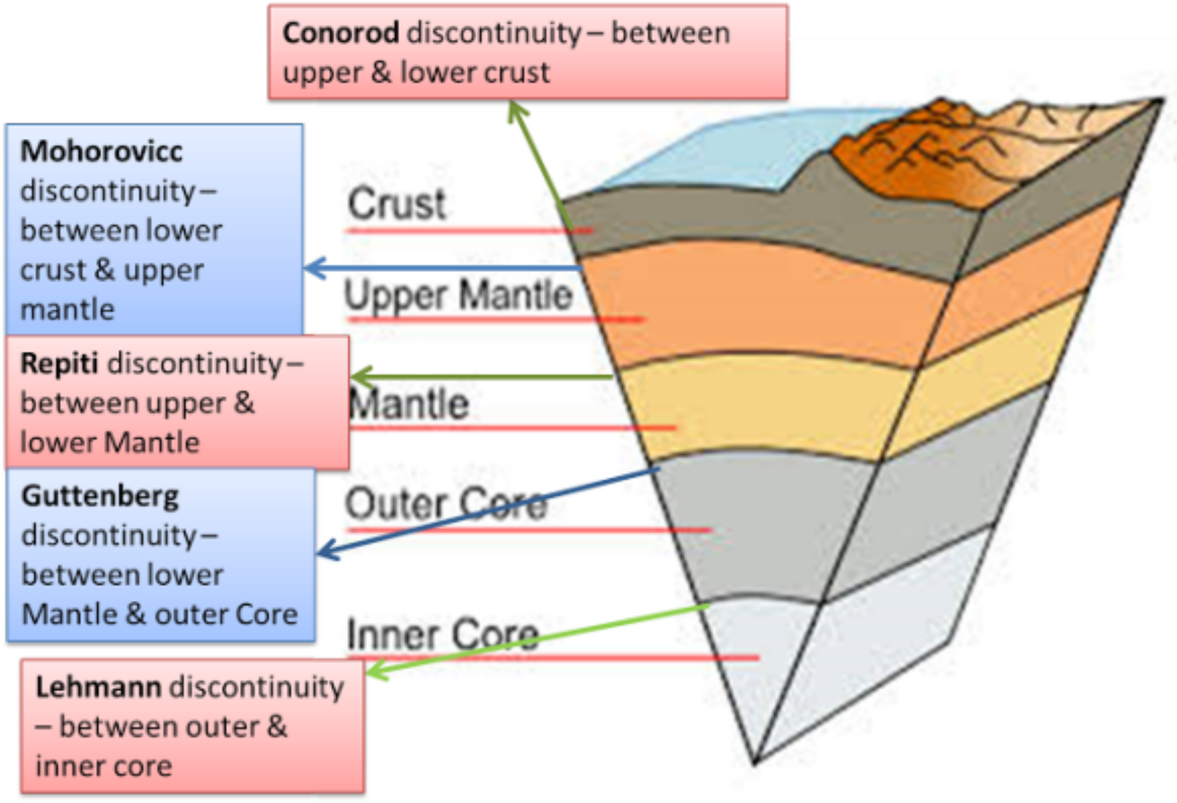

Image source: https://rashidfaridi.com/2017/08/31/discontinuities-inside-the-earth/

For more details: https://www.encyclopedia.com/science/encyclopedias-almanacs-transcripts-and-maps/earth-interior-structure