POLES APART

What is Earth’s magnetic field, could the magnetic poles flip and would it lead to mass extinction?

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DOOMSDAY theorists are discussing claims the Earth's magnetic poles could be about to flip - with catastrophic results for civilisation and potentially even mass extinctions.

Geomagnetic polar reversals happen every few hundred thousand years, with some arguing the next one is overdue. Here is our guide.

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This Nasa illustration depicts Earth's magnetic field

What is a geomagnetic reversal?

The Earth is surrounded by a magnetic force field, generated by electric currents in the molten iron that flows in the outer core of our planet.

People cannot feel it but compass needles are moved by this force and swing towards magnetic north.

Magnetic poles are not the same as the North and South Pole, also called the geographic poles, which are on the Earth's axis of rotation.

The difference between magnetic north and true north is around 11 degrees.

Over the last century or so, scientists have discovered the direction of the geomagnetic field slowly wanders around.

The position of magnetic north is more than 600 miles from where it was in the early 19th century, and the movement has accelerated to around 40 miles a year.

And it has moved much more than this in the past.

Geological records show the field has "flipped" completely upside down hundreds of times over the last half a billion years.

This is revealed in volcanic rocks that contain iron-rich minerals, which are aligned in the direction of the magnetic field as the lava cools and sets hard.

During a reversal the poles are at opposite ends of the planet from where they are now - so a compass would point roughly towards the South Pole.

The earth's magnetic fields flip upside down every few hundred thousand years

It is believed these reversals occur when natural fluctuations in magnetism within the core interfere with the main field.

The field may weaken, with poles reappearing at different points on the globe before they settle more or less in line with the axis.

This is the most stable position thanks to gyroscopic forces.

Around 41,000 years ago there was a brief "flip" - called an excursion - before the field returned back to normal after a few hundred years.

Is a geomagnetic reversal overdue?

Reversals have occurred roughly every 450,000 years on average.

The last proper one happened around 780,000 years ago - an event known as the Brunhes-Matuyama reversal.

This has led some to say the next one must be "overdue".

Measurements have also suggested the Earth's magnetic field has been weakening in some places, which some scientists take as a sign the process is beginning.

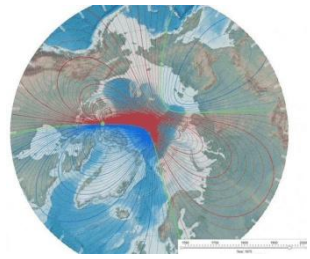
In fact the field is still much stronger than at various points in the geological record.

Long-term records show the timescale of reversals is random.

Sometimes it has happened relatively often - including 51 times in the space of 12million years, and twice within 50,000 years.

There have also been very long periods - called superchrons - with no reversals at all for up to 50million years.

The truth is scientists have no way of predicting when the next one will come.



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The earth's magnetic poles are moving by up to 40 miles a year

Will a magnetic reversal bring catastrophe?

Some doom-mongers believe a dip in the strength of the magnetic field would leave us vulnerable to cosmic radiation.

Some experts have even linked polar reversals to mass extinctions because of deadly particles raining down on the planet.

According to a book extract reported on Undark, an imminent flip could cause "devastating streams of particles from the sun, galactic cosmic rays, and enhanced ultraviolet B rays".

The article shared concerns from Daniel Baker, director of the Laboratory for Atmospheric and Space Physics at the University of Colorado, Boulder.

He warned that "parts of the planet will become uninhabitable during a reversal".

The report also warned satellite timing systems that govern electric grids could fail, causing a ripple effect that would shut off lights, computers and phones.

Even flushing the toilet could become impossible, according to the article.

If power grids and phone networks were really disabled, the result would be chaos and a crippling of the modern economy.

Nasa says we don't need to worry.

The US space agency said: "Many doomsday theorists have tried to take this natural geological occurrence and suggest it could lead to Earth's destruction.

"But would there be any dramatic effects?

"The answer, from the geologic and fossil records we have from hundreds of past magnetic polarity reversals, seems to be 'no'."

Fossil records from the last flip 780,000 years ago show no difference in animal and plant life before and after.

Geomagnetics expert Dr Monika Korte said: "Even if the field becomes very weak, at the Earth's surface we are shielded from radiation by the atmosphere.

"Similarly, as we cannot see or feel the presence of the geomagnetic field now, we most likely would not notice any significant change from a reversal."

Plus, when a reversal does happen it is unlikely to be sudden.

Scientists believe the process takes up to 1,000 years each time.