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News Features

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NASA Maps Electric Currents Around Mars

https://www.dailymail.co.uk/sciencetech/article-8376781/NASA-map-shows-Red-Planet-DOES-magnetic-field-sorts.html

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Daily Mail 1st June 2020 >

- **Scientists have revealed electric currents flowing from the day to the night side**
- **These help to generate and mould the Induced magnetosphere around Mars**
- **NASA made the find using five years of data from its orbiting MAVEN spacecraft**

Electric currents around Mars, which are responsible for generating a magnetic field around the planet, have been mapped by NASA for the first time.

Unlike the Earth, whose magnetism comes from its molten core, Mars does not generate a magnetic field on its own.

However, as solar wind smashes into the planet's upper atmosphere at around a million miles per hour, it strips electrons from atoms, making them highly conductive.

These electrons and protons are forced to flow apart due to their opposite electric charge, forming electric currents that drape around the planet from the 'day side' to the 'night side', like spaghetti wrapping around a basketball.

This creates a so-called 'induced magnetosphere', preventing some radiation from reaching its surface.

Now NASA has mapped this magnetic field for the first time, from its generation in the solar wind, to where the electrical energy is deposited in the upper atmosphere.

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It is hoped this research will inform efforts to understand the planet's atmosphere and how it has changed over time.

NASA has been able to create the map after its MAVEN spacecraft spent five years orbiting the planet and measuring its magnetic field.

It looked for distortions in solar wind, which reveal the positions of electric currents.

The data was used to map out the average magnetic field structure around Mars in 3D and calculate the currents directly from their distortions.

'Mars' atmosphere behaves like a metal sphere closing an electric circuit,' said experimental physicist Robin Ramstad from the University of Colorado, Boulder.

'The currents flow in the upper atmosphere, with the strongest current layers persisting at 120 - 200 kilometres (75 to 125 miles) above the planet's surface.

He explained: 'We take magnetic field data and we map it around the planet and from that the currents emerge.'

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'When you just look as the data as it comes down, you're seeing a little squiggly line essentially. You're seeing the magnetic field's strength and direction vary as the spacecraft moves through the area.

'What you have to do is you have to actually map it to the planet and to its interaction with the solar wind, and then it starts to emerge that you have a drape situation.'

Earth's magnetic field, which comes from its molten core, surrounds the entire planet and blocks harmful solar wind from reaching the surface.

As Mars doesn't have a magnetic core, it lacks this protective layer, making it easier for particles to escape its atmosphere into space and causing damage to its surface.

NASA hopes that by studying the rate at which these particles escapes it will be able to model how the atmosphere has changed overtime, and how its thickness has changed.

'These currents play a fundamental role in the atmospheric loss that transformed Mars from a world that could have supported life into an inhospitable desert,' said Dr Ramstad.

'We are now currently working on using the currents to determine the precise amount of energy that is drawn from the solar wind and powers atmospheric escape.'

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Scientists have mapped the magnetic fields wrapping around Mars for the first time (shown). Generator current: The current made by the impact of solar wind on particles around the planet. Load current: The current passing through the upper atmosphere

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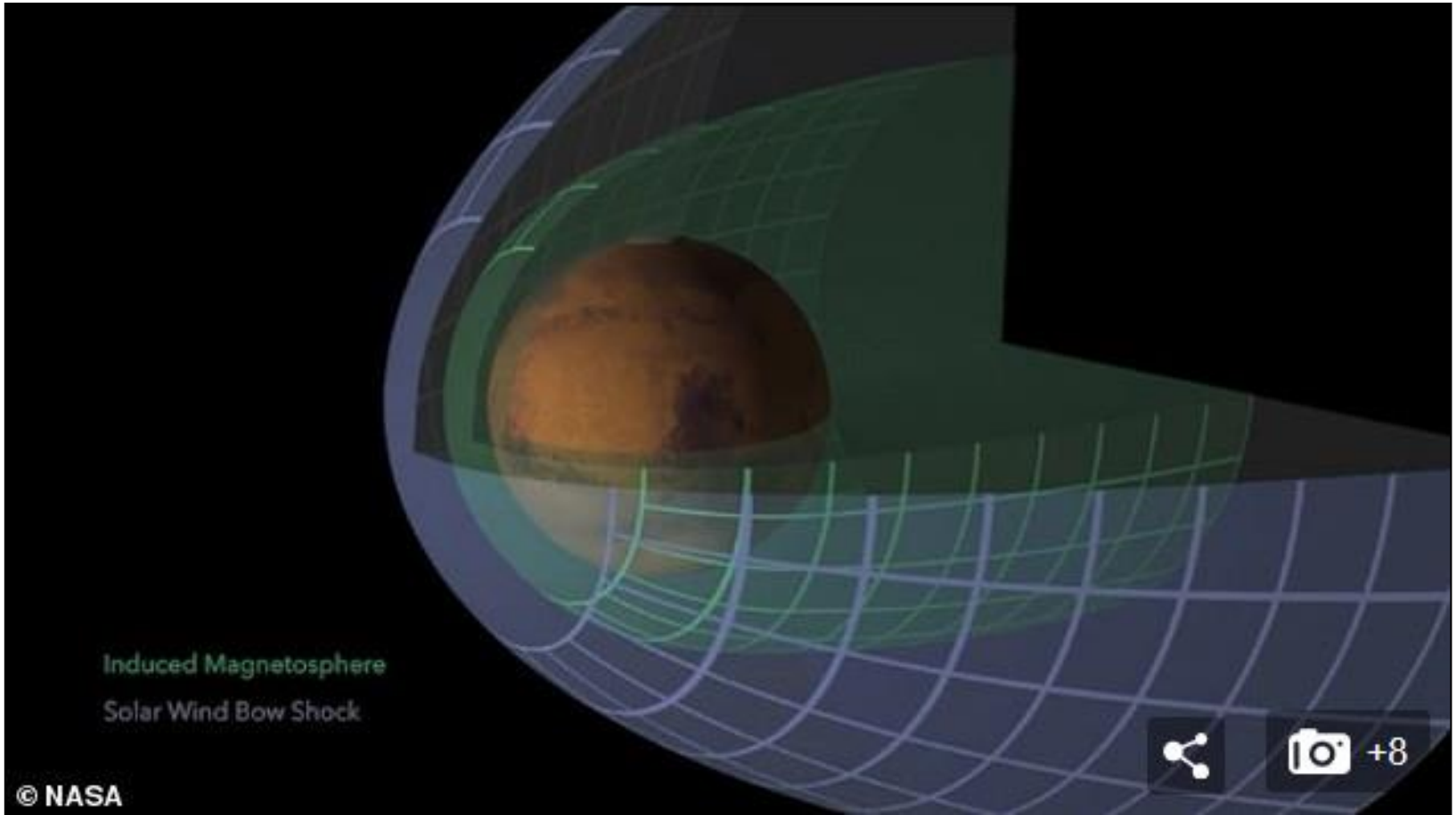
he Martian magnetic field helps protect the planet from damaging solar wind. This shows Mars's induced magnetosphere, created by the upper atmosphere, and the shock from the solar wind



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Scientists believe Mars holds large volumes of water but much of it is stored in ice or in brine patches

How important is the presence of liquid water?
It is now widely believed that Mars holds a reasonably large volume of water.

However, the surface of the planet is so cold, this water exists only as ice.

In order for life to exist on a planet, many scientists believe it is essential for the world to possess liquid water.

Ever since technology has enabled mankind to gaze at Mars in detail, humans have been looking for indications that there was water on the red planet.

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Did water used to flow on the surface of Mars?

The Mariner 9 mission revealed clues of water erosion in river beds and canyons, as well as evidence of weather fronts and fogs on Mars in 1971.

Later missions from the Viking orbiters, which first launched in 1975, revealed yet more details about how water flowed on the surface and carved valleys.

Several studies investigated the presence of liquid water for decades. In 2000, the first proof of liquid water on Mars was discovered.

It was claimed the gullies seen on the surface of the planet had to have been formed by flowing water.

Scientists cited the debris and mud deposits left behind as evidence for moving water existing at some point in the history of the red planet.

However, the formation of these gullies has been hotly debated throughout the ensuing years.

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Proof of ice in geological samples from Mars

Spirit and Opportunity, the twin rovers, found evidence of the presence of water enclosed in rock in 2007, when one of Spirit's wheels broke and gorged a piece of stone.

Analysis of the silica-rich layer discovered in the scratch suggested it formed in the presence of liquid water.

In 2008, the Phoenix lander was gathering geological samples, and they disappeared after a few days.

Scientists thought these were pieces of ice. This assessment was confirmed when the lander later detected water vapour in a sample.

In 2012, Curiosity was meandering over an ancient martian seabed when it examined a number of rocks that were exposed to liquid water billions of years ago.

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Recurring slope lineae and debate causes it

Features known as recurring slope lineae (RSL) were first identified in 2011.

These dark streaks populate the areas of Mars with a sharp incline.

Researchers speculated that these may have been caused by the intermittent flow of liquid water down steep banks on the planet.

In June 2013, Curiosity found powerful evidence that water good enough to drink once flowed on Mars. In September of the same year, the first scoop of soil analysed by Curiosity revealed that fine materials on the surface of the planet contain two per cent water by weight.

In 2015, Nasa claimed to have discovered the first evidence of liquid water on Mars in the present day.

The space agency said that its Mars Reconnaissance Orbiter (MRO) provided the strongest evidence yet that liquid water flows intermittently on present-day Mars.

In 2017, Nasa issued another statement rebuking its initial findings.

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It said the dark features that run down steep inclines on the red planet were actually granular flows, where grains of sand and dust slip downhill to make dark streaks, rather than the ground being darkened by seeping water.

Images from the MRO revealed the streaks only exist on slopes steep enough for dry grains to descend the way they do on faces of active dunes.

Also in 2017, scientists provided the best estimates for water on Mars, claiming it once had more liquid H2O than the Arctic Ocean - and the planet kept these oceans for more than 1.5 billion years.

The findings suggest there was ample time and water for life on Mars to thrive, but over the last 3.7 billion years the red planet has lost 87 per cent of its water - leaving the surface barren and dry.

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A subterranean lake

In a study published in the journal Science, ESO researchers have now discovered the first concrete evidence for liquid water on Mars.

Using radar imagery from the Mars Express probe, the ESO team have found a 12-mile long underground lake filled with liquid water.