BBC **2021 REVIEW** **PSYCHEDELICS, MARS, CRISPR AND MORE...**

Science Focus

The truth about
THE NEW 'SUPER COLD'

Inside Elon Musk's
STARBASE: CITY OF THE FUTURE

Closing in on a
VARIANT-PROOF VACCINE

END OF YEAR Q&A

SPECIAL ISSUE

Are spiders getting bigger? Can air travel ever be green?

Is COVID-19 endemic? Can you cook a turkey by dropping it from space?

Is working from home good for the environment? Are Asian wasps invading?

Why do anxious thoughts arrive late at night? Do four-day weeks work?

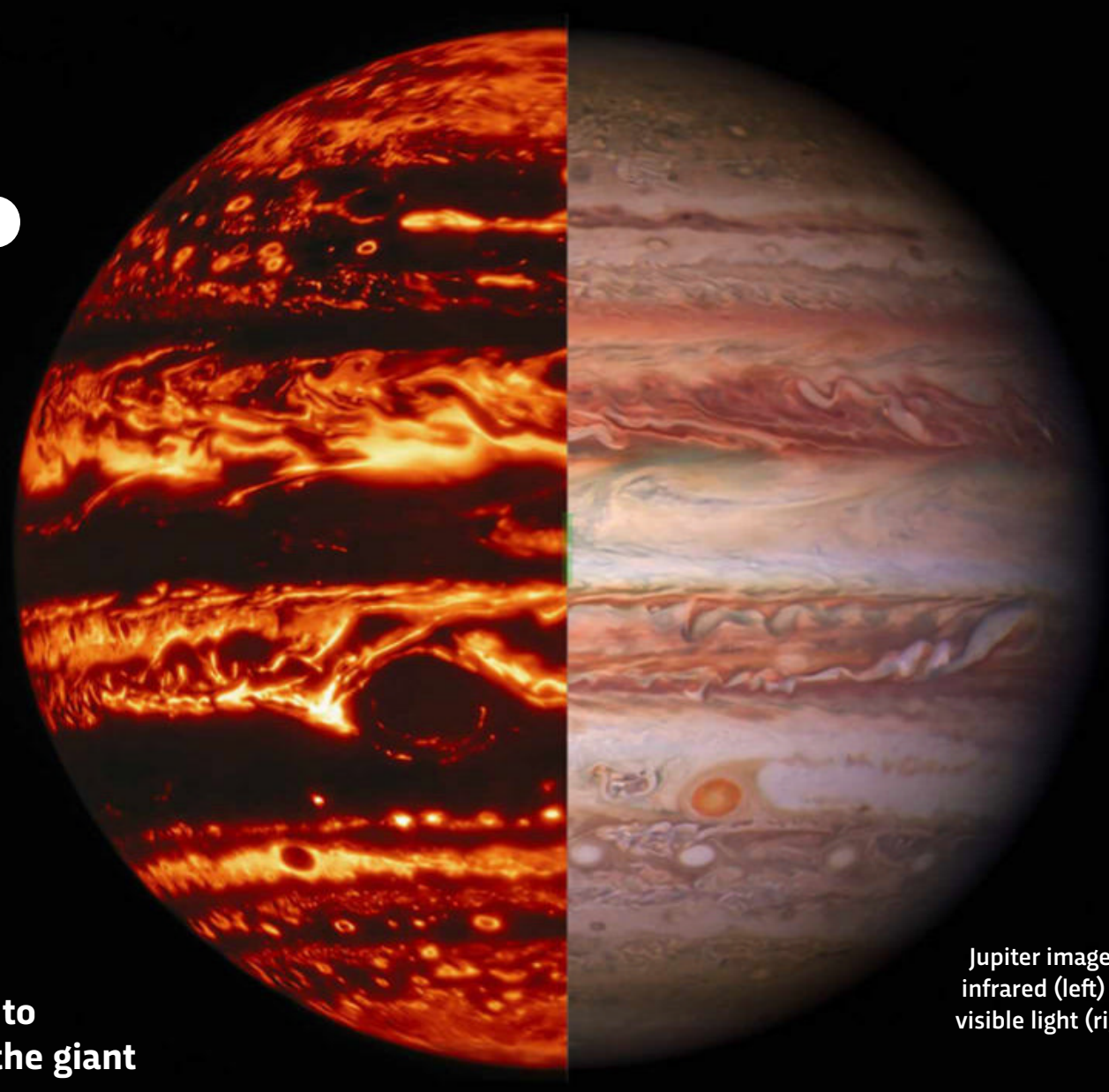
Is your sourdough bread unique? Does Netflix cost the Earth?

PLUS BRAIN GAMES TEST YOUR KNOWLEDGE WITH OUR CRACKING CHRISTMAS CONUNDRUMS

SCIENCEFOCUS.COM
#371 DECEMBER 2021
UK £5.50

SPACE

NASA's Juno spacecraft probes the depths of Jupiter's Great Red Spot



Jupiter imaged in infrared (left) and visible light (right)

The iconic storm stretches down to between 350 and 500km below the giant planet's swirling clouds

Since entering Jupiter's orbit in 2016, NASA's Juno spacecraft has completed 37 flybys of the giant planet, shedding light on the unseen processes raging beneath its clouds with each pass.

Now, scientists studying data taken by the spacecraft's microwave radiometer (MWR) and NASA's Earth-based Deep Space Network tracking antenna have made new insights into the structure of one of Jupiter's most iconic features, the Great Red Spot. With its bright crimson hue and diameter wider than the Earth, this enigmatic anticyclone has captured the imagination of astronomers since its discovery two centuries ago.

Data from the MWR shows that cyclones – large-scale air masses that rotate anticlockwise around a centre of low atmospheric pressure – within the giant planet's atmosphere in the northern hemisphere are warmer near the top and colder near the bottom. While anticyclones, such as the Great Red Spot, rotate in the opposite direction and are colder at the top but warmer at the bottom.

The findings also indicate these storms are far taller than expected, with some extending 100 kilometres below the cloud tops and others, including the Great Red Spot, reaching more than 350 kilometres.

"Previously, Juno surprised us with hints that phenomena in Jupiter's atmosphere went deeper than expected," said Dr Scott Bolton, principal investigator of Juno from the Southwest Research Institute in San Antonio, Texas. "Now, we're starting to put all these individual pieces together and getting our first real understanding of how Jupiter's beautiful and violent atmosphere works – in 3D."

> "We are getting our first understanding of how Jupiter's beautiful, violent atmosphere works"

A second team of researchers then used data on Jupiter's gravity field recorded by NASA's Earth-based Deep Space Network tracking antenna to produce a second estimate of the Great Red Spot's depth. As the Great Red Spot is so large, Juno can feel small gravitational tugs as it flies over it. By measuring tiny changes in Juno's velocity as small as 0.01 millimetre per second due to the changes in gravitational pull, the team produced an estimate of the Great Red Spot's depth of around 500 kilometres. When combined with the MWR data, this suggests the anticyclone is between 350 and 500 kilometres deep.

"The precision required to get the Great Red Spot's gravity during the July 2019 flyby is staggering," said lead author Dr Marzia Parisi, a Juno scientist from NASA's Jet Propulsion Laboratory in southern California. "Being able to complement MWR's finding on the depth gives us great confidence that future gravity experiments at Jupiter will yield equally intriguing results."

NASA/JPL, GETTY IMAGES