Celestial Observer

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CCAS member Robin White shot this image of NGC 1499, also known as the California Nebula. Resembling the shape of California (turned to the side, in this image), this nebula is located in the constellation Perseus. Although difficult to see, it is visible during the Fall and Winter months, rising in the East to Northeastern sky and setting in the Northwest.

Next Star Gazing: ONLINE!
Friday, December 3rd at 7pm PST

CCAS President Aurora Lipper, and astronomer Brian Cox will be taking you on a virtual tour of the December night sky, so you can stargaze right from home!

Connect here:
CentralCoastAstronomy.org/stargaze

November Partial Lunar Eclipse!

On the evening of November 18th and into the early morning hours of the 19th, the longest Partial Lunar Eclipse in nearly 600 years will occur! Check out the link below for more information and to find out when it's visible near you.

Space.com/beaver-moon-lunar-eclipse-2021-guide

Next Stargazing: ONLINE! Invite friends!!

Friday, December 3rd at 7pm PST

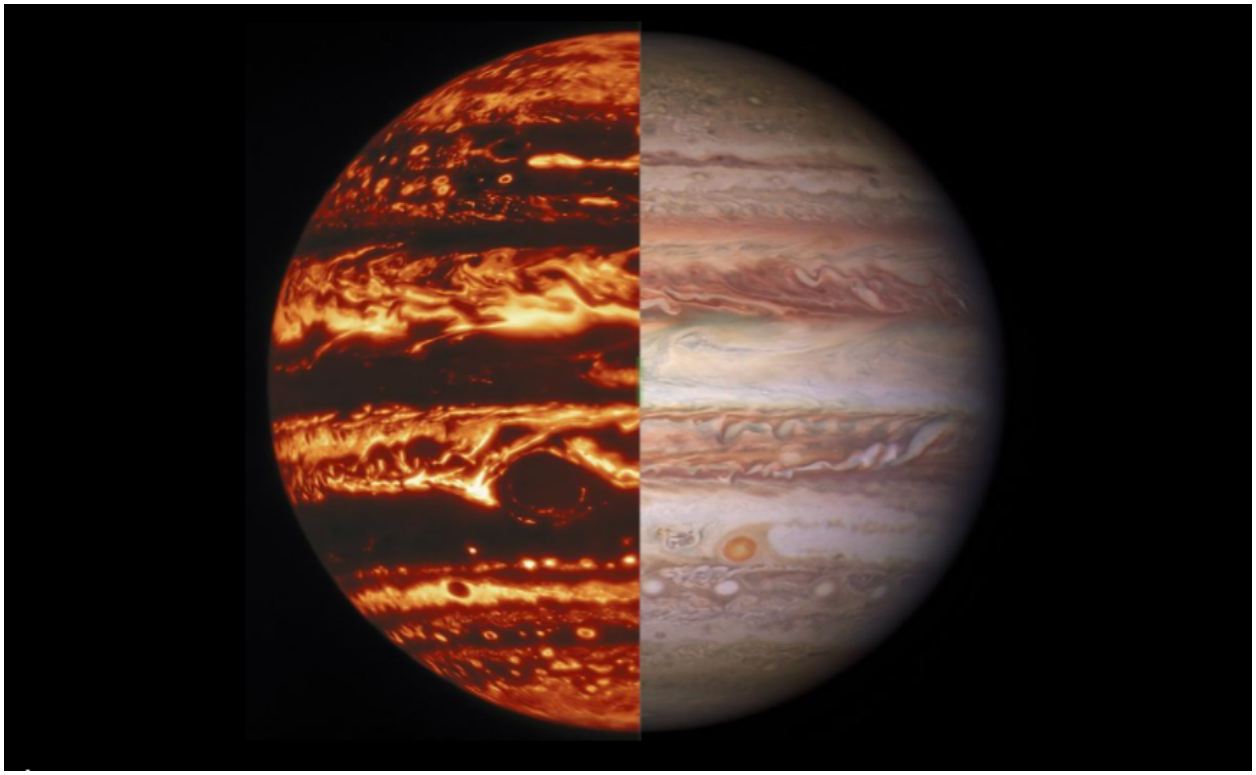
On December 3rd, CCAS President Aurora Lipper, along with amateur astronomer Brian Cox will present a live tour of the December sky. You'll learn about objects visible naked-eye, through binoculars, and through a telescope. Then, using the tools you learn during the video, you'll be able to stargaze from the comfort of your own home! Brian will also be presenting live views of some of the objects through his telescope at home (weather permitting)!

Invite all your friends! Anyone with the link can view our free online stargazing session. All that's needed is an internet connection. Join the stream using any tablet, personal computer, or YouTube enabled TV. After the presentation, the video will be available on demand on our YouTube channel. Check our website for all the details:

CentralCoastAstronomy.org/stargaze

NASA’s Juno: Science Results Offer First 3D View of Jupiter Atmosphere

by NASA JPL



Jupiter's banded appearance is created by the cloud-forming weather layer. This composite image shows views of Jupiter in infrared and visible light taken by the Gemini North telescope and NASA's Hubble Space Telescope. Credit: International Gemini Observatory/NOIRLab/NSF/AURA/NASA/ESA, M.H. Wong and I. de Pater (UC Berkeley) et al.

NASA’s Jovian orbiter lends deeper understanding of what happens below the gas giant’s striking clouds.

New findings from NASA’s Juno probe orbiting Jupiter provide a fuller picture of how the planet’s distinctive and colorful atmospheric features offer clues about the unseen processes below its clouds. The results highlight the inner workings of the belts and zones of clouds encircling Jupiter, as well as its polar cyclones and even the Great Red Spot.

Researchers published several papers on Juno’s atmospheric discoveries today in the journal Science and the Journal of Geophysical Research: Planets. Additional papers appeared in two recent issues of Geophysical Research Letters.

“These new observations from Juno open up a treasure chest of new information about Jupiter’s enigmatic observable features,” said Lori Glaze, director of NASA’s planetary science division at the agency’s headquarters in Washington. “Each paper sheds light on different aspects of the planet’s atmospheric processes – a wonderful example of how our internationally-diverse science teams strengthen understanding of our solar system.”

Juno entered Jupiter’s orbit in 2016. During each of the spacecraft’s 37 passes of the planet to date, a specialized suite of instruments has peered below its turbulent cloud deck.

“Previously, Juno surprised us with hints that phenomena in Jupiter’s atmosphere went deeper than expected,” said Scott Bolton, principal investigator of Juno from the Southwest Research Institute in San Antonio and lead author of the Science journal paper on the depth of Jupiter’s vortices. “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.”

Juno’s microwave radiometer (MWR) allows mission scientists to peer beneath Jupiter’s cloud tops and probe the structure of its numerous vortex storms. The most famous of these storms is the iconic anticyclone known as the Great Red Spot. Wider than Earth, this crimson vortex has intrigued scientists since its discovery almost two centuries ago.

The new results show that the cyclones are warmer on top, with lower atmospheric densities, while they are colder at the bottom, with higher densities. Anticyclones, which rotate in the opposite direction, are colder at the top but warmer at the bottom.

The findings also indicate these storms are far taller than expected, with some extending 60 miles (100 kilometers) below the cloud tops and others, including the Great Red Spot, extending over 200 miles (350 kilometers). This surprise discovery demonstrates that the vortices cover regions beyond those where water condenses and clouds form, below the depth where sunlight warms the atmosphere.

The height and size of the Great Red Spot means the concentration of atmospheric mass within the storm potentially could be detectable by instruments studying Jupiter’s gravity field. Two close Juno flybys over Jupiter’s most famous spot provided the opportunity to search for the storm’s gravity signature and complement the MWR results on its depth.

With Juno traveling low over Jupiter’s cloud deck at about 130,000 mph (209,000 kph) Juno scientists were able to measure velocity changes as small 0.01 millimeter per second using a NASA Deep Space Network tracking antenna, from a distance of more than

400 million miles (650 million kilometers). This enabled the team to constrain the depth of the Great Red Spot to about 300 miles (500 kilometers) below the cloud tops.

“The precision required to get the Great Red Spot’s gravity during the July 2019 flyby is staggering,” said Marzia Parisi, a Juno scientist from NASA’s Jet Propulsion Laboratory in Southern California and lead author of a paper in the journal Science on gravity overflights of the Great Red Spot. “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.”

Belts and Zones

In addition to cyclones and anticyclones, Jupiter is known for its distinctive belts and zones – white and reddish bands of clouds that wrap around the planet. Strong east-west winds moving in opposite directions separate the bands. Juno previously discovered that these winds, or jet streams, reach depths of about 2,000 miles (roughly 3,200 kilometers). Researchers are still trying to solve the mystery of how the jet streams form. Data collected by Juno’s MWR during multiple passes reveal one possible clue: that the atmosphere’s ammonia gas travels up and down in remarkable alignment with the observed jet streams.

“By following the ammonia, we found circulation cells in both the north and south hemispheres that are similar in nature to ‘Ferrel cells,’ which control much of our climate here on Earth,” said Keren Duer, a graduate student from the Weizmann Institute of Science in Israel and lead author of the Science journal paper on Ferrel-like cells on Jupiter. “While Earth has one Ferrel cell per hemisphere, Jupiter has eight – each at least 30 times larger.”

Juno’s MWR data also shows that the belts and zones undergo a transition around 40 miles (65 kilometers) beneath Jupiter’s water clouds. At shallow depths, Jupiter’s belts are brighter in microwave light than the neighboring zones. But at deeper levels, below the water clouds, the opposite is true – which reveals a similarity to our oceans.

“We are calling this level the ‘Jovicline’ in analogy to a transitional layer seen in Earth’s oceans, known as the thermocline – where seawater transitions sharply from being relative warm to relative cold,” said Leigh Fletcher, a Juno participating scientist from the University of Leicester in the United Kingdom and lead author of the paper in the Journal of Geophysical Research: Planets highlighting Juno’s microwave observations of Jupiter's temperate belts and zones.

Polar Cyclones

Juno previously discovered polygonal arrangements of giant cyclonic storms at both of Jupiter's poles – eight arranged in an octagonal pattern in the north and five arranged in a pentagonal pattern in the south. Now, five years later, mission scientists using observations by the spacecraft's Jovian Infrared Auroral Mapper (JIRAM) have determined these atmospheric phenomena are extremely resilient, remaining in the same location.

"Jupiter's cyclones affect each other's motion, causing them to oscillate about an equilibrium position," said Alessandro Mura, a Juno co-investigator at the National Institute for Astrophysics in Rome and lead author of a recent paper in Geophysical Research Letters on oscillations and stability in Jupiter's polar cyclones. "The behavior of these slow oscillations suggests that they have deep roots."

JIRAM data also indicates that, like hurricanes on Earth, these cyclones want to move poleward, but cyclones located at the center of each pole push them back. This balance explains where the cyclones reside and the different numbers at each pole.

More About the Mission

JPL, a division of Caltech in Pasadena, California, manages the Juno mission. Juno is part of NASA's New Frontiers Program, which is managed at NASA's Marshall Space Flight Center in Huntsville, Alabama, for the agency's Science Mission Directorate in Washington. Lockheed Martin Space in Denver built and operates the spacecraft.

Get more information about Juno online at:

https://www.nasa.gov/juno

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CCAS Information

Founded in 1979, the Central Coast Astronomical Society (CCAS) is an association of people who share a common interest in astronomy and related sciences.

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CCAS member Jake Crafton took this image of the Andromeda Galaxy (M31 or NGC 224). This photo consists of approximately 10 minutes of data stacked from 5x120 second exposures. Andromeda can be seen naked-eye with a dark sky, and is currently high in the sky shortly after sunset.