Scientists are thrilled with Juno's brilliant close-up images of Jupiter

By Ian Sample, The Guardian, adapted by Newsela staff on 05.30.17
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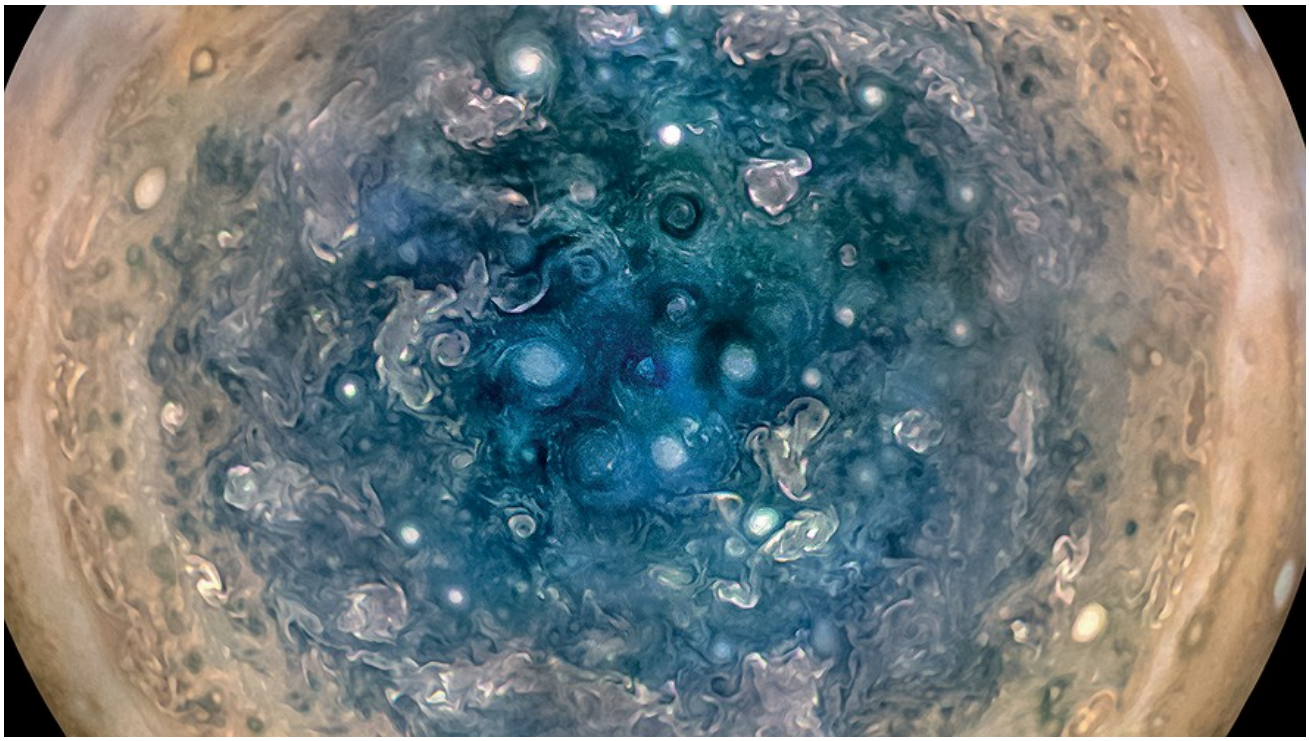

Jupiter's south pole, as seen by the Juno spacecraft from an altitude of 32,000 miles (52,000 kilometers). The oval features are cyclones, up to 600 miles (1,000 kilometers) in diameter. Photo: NASA/JPL-Caltech/SwRI/MSSS/Betsy Asher Hall/ Gervasio Robles

NASA's Juno spacecraft has captured towering clouds, swirling cyclones and dramatic flows of ammonia. They are the first close-up images of Jupiter, the largest planet in the solar system.

Flows of ammonia are what drive the giant weather systems on the fifth planet from the sun. Ammonia crystals form clouds, which swirl around Jupiter's atmosphere.

The $1.1 billion unmanned spacecraft swung into orbit around Jupiter in July 2016. Juno's mission is to peer through the thick clouds that shroud the planet and learn how the alien world formed around the sun 4.5 billion years ago.

"We were all jumping up and down with excitement when the images came down," said Fran Bagenal, a planetary space scientist at the University of Colorado. She joined the Juno mission more than a decade ago. "You've got to be patient, but the rewards are fantastic."

Scientists Marvel At The Details

The spacecraft survived a nearly six-year, 2.8-billion-kilometer (1.7-billion- mile) voyage across the depths of space. Then it ducked beneath Jupiter's intense radiation belts and turned on its array of instruments. It swept into an orbit that loops over the planet's north and south poles.

From 5,000 kilometers (3,107 miles) above the brown-orange blanket that covers the planet, Juno's camera snapped pictures. The photos showed tall, white storm clouds standing high above the rest. Some of the storm clouds were high enough that they stood out even on the side of the planet facing away from the sun.

More images revealed flashes of lightning in the Jupiter sky. "The weather is dramatic," Bagenal said. "What we thought we knew about Jupiter, we underestimated. It's more variable, there are more features, there is much more detail the closer you look."

Light Shows At Jupiter's Poles

Jupiter is an enormous gas giant made from hydrogen and helium. All of the other planets in the solar system could fit inside of Jupiter, a planet 11 times wider than Earth.

Writing in the journal Science recently, the Juno team described the new images and measurements. The spacecraft gathered information on the planet's atmosphere, magnetic field and the brilliant non-stop light shows at Jupiter's poles.

As Juno swooped around the planet, it spotted chaotic scenes with bright oval-shaped features swirling in the clouds. Time-lapse images revealed them to be enormous cyclones, rotating counter-clockwise in Jupiter's northern hemisphere. The storms reached up to 1,400 kilometers (870 miles) wide. They are more than 10 times the size of the largest cyclones on Earth.

Secrets Of Jupiter's Atmosphere

Deep inside Jupiter's atmosphere, the scientists found evidence for what they called an "equatorial plume." It is a massive overturning of gas driven by a stream of ammonia from around the planet's equator. Ammonia is a gas compound of nitrogen and hydrogen. Jupiter's equatorial plume seems to mirror the Hadley cell convection currents on Earth, where warm air rises at the equator and falls again about 30 degrees to the north and south.

However, scientists do not have it all figured out quite yet. "It looks like a band that goes all the way around the middle of Jupiter," Bagenal said. "The question is where does it go down?"

Another instrument on Juno measured the magnetic field of the planet and found it to be twice as strong as scientists expected. Planetary magnetic fields are the result of liquids in a planet's core. These liquids conduct electricity. Earth's magnetic field is like a giant bar magnet from

the North to South Poles. A planet's magnetic field deflects charged particles from the sun, also known as solar wind. Information gathered by Juno showed that Jupiter's magnetic field is about 10 times stronger than the field that surrounds Earth.

Juno Has Much More To Observe

Juno also provided new insight on Jupiter's aurorae or light shows. On Earth, the collision of gas particles results in a similar, but much smaller light show. It is known as the Northern Lights, or aurora borealis, and Southern Lights, or aurora australis. During observations of Jupiter's aurorae, Juno detected streams of electrons hurtling down into the planet's upper atmosphere. They potentially power the spectacular light shows.

Over the coming months, Juno will build up a map of the planet's interior before its instruments surrender to the harsh radiation. The spacecraft will plunge into the clouds at the end of its mission. Along for the ride are three Lego crewmembers: the Roman god Jupiter, his wife Juno, and a telescope-carrying Galileo. The toy figure of Galileo represents the astronomer who discovered four of Jupiter's 53 moons.

One mystery scientists want to clear up is whether Jupiter has a solid core. With more data from Juno, it is a puzzle they hope to answer. "We're having to put together this 3-D puzzle," Bagenal said. "And surprise, surprise, it isn't like Earth."

Quiz

1 Which section of the article highlights the process of Juno's journey to reach Jupiter?

(A) "Scientists Marvel At The Details"

(B) "Light Shows At Jupiter's Poles"

(C) "Secrets Of Jupiter's Atmosphere"

(D) "Juno Has Much More To Observe"

2 Which paragraph in the section "Secrets Of Jupiter's Atmosphere" BEST suggests that scientists were surprised by one of Juno's findings?

3 Read the paragraph from the section "Juno Has Much More To Observe."

> *Juno also provided new insight on Jupiter's aurorae or light shows. On Earth, the collision of gas particles results in a similar, but much smaller light show. It is known as the Northern Lights, or aurora borealis, and Southern Lights, or aurora australis. During observations of Jupiter's aurorae, Juno detected streams of electrons hurtling down into the planet's upper atmosphere. They potentially power the spectacular light shows.*

Based on the information in the paragraph, which of the following words BEST matches the definition of the word "insight" as used above?

(A) evidence

(B) judgment

(C) prediction

(D) understanding

4 Read the sentence from the introduction [paragraphs 1-4].

NASA's Juno spacecraft has captured towering clouds, swirling cyclones and dramatic flows of ammonia.

HOW does the word "dramatic" affect the tone of the sentence?

(A) It creates a sense of chaos.

(B) It creates a sense of urgency.

(C) It creates a sense of intensity.

(D) It creates a sense of imagination.