

A composite image of Jupiter. The top portion shows a vibrant blue and purple auroral glow against the dark space. The bottom portion shows the planet's characteristic cloud bands in shades of brown, tan, and white. A white, hand-drawn style rectangular border with rounded corners frames the central text.

Jupiter's Spectacular Ultraviolet “Dawn Storm” Auroras Are Surprisingly Earth-Like

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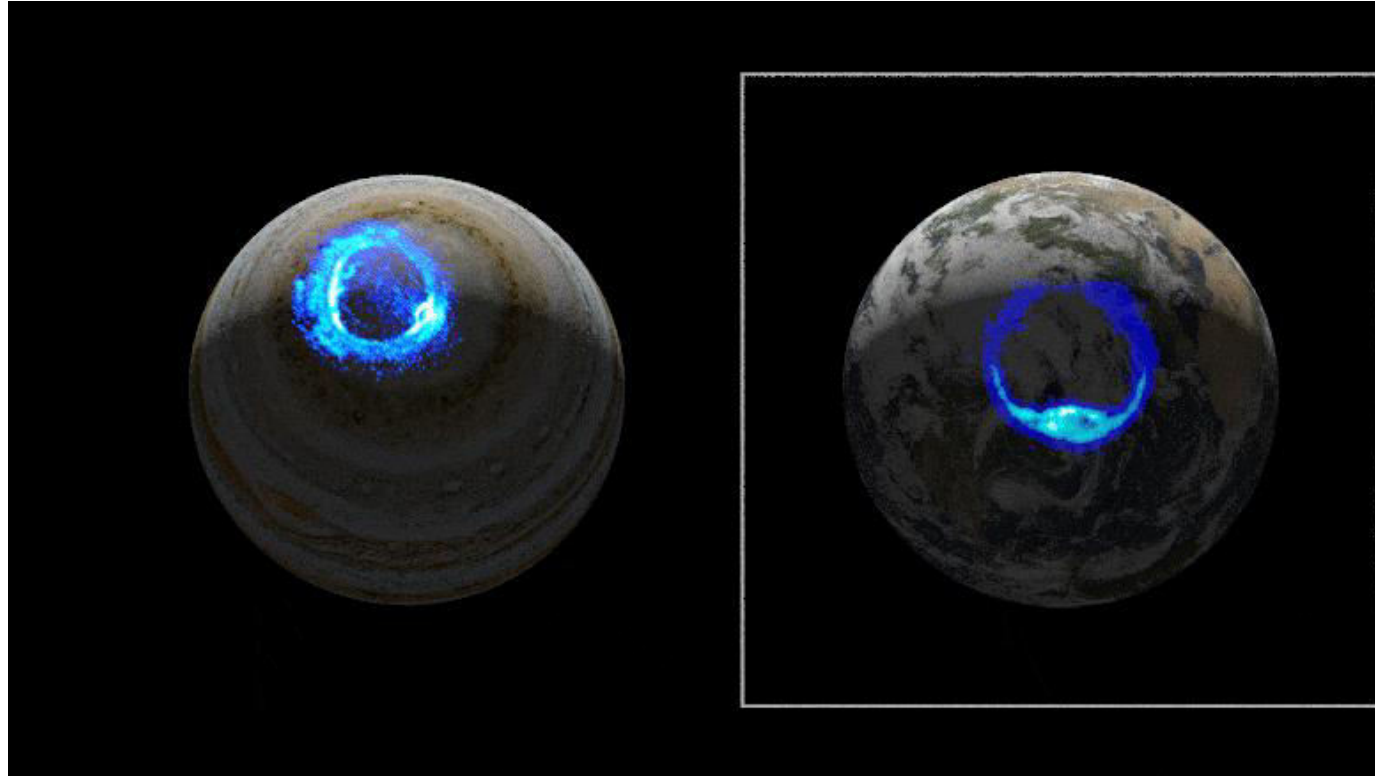
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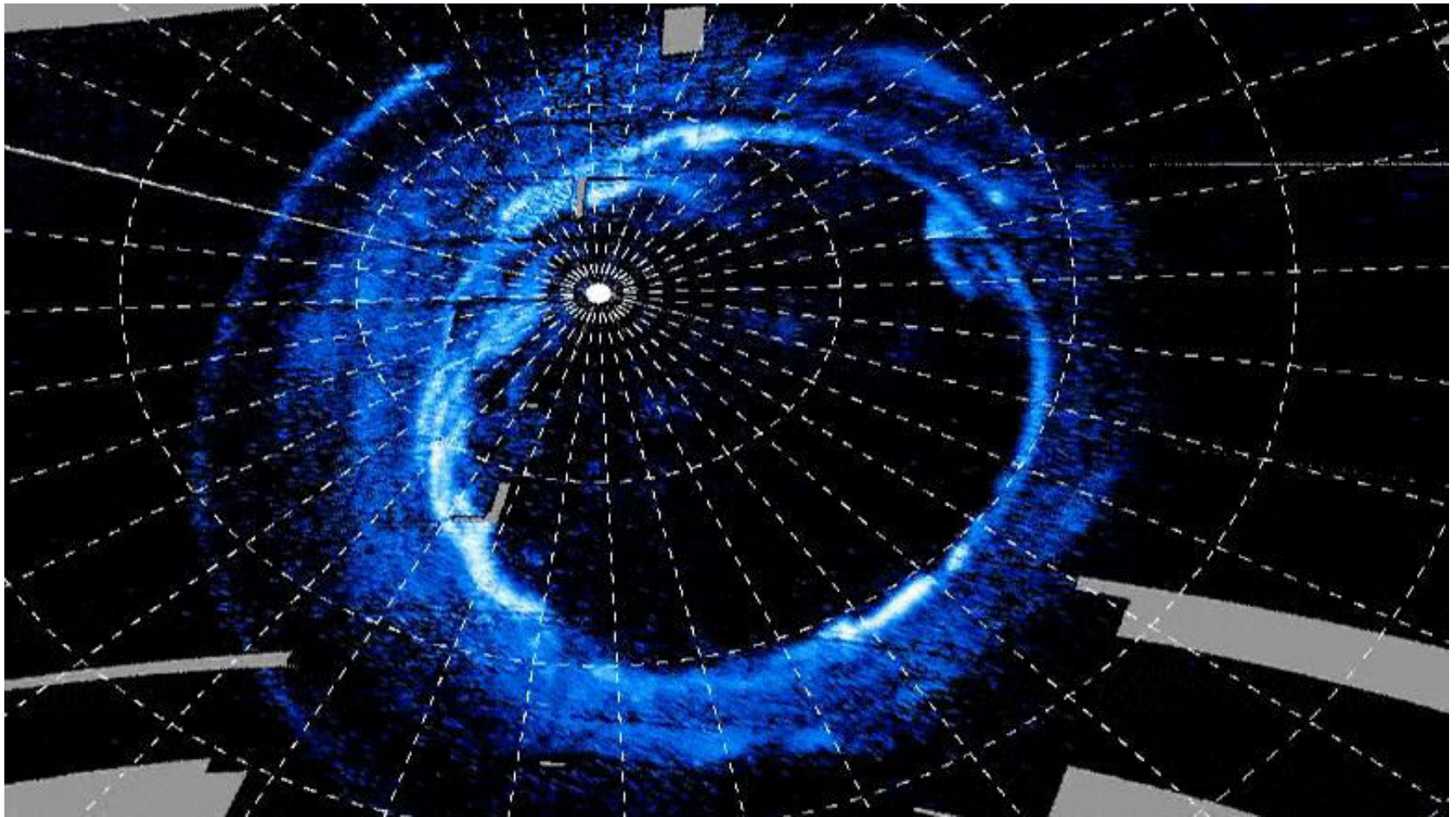
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Even if Jupiter's diameter is ten times larger than the Earth's, this illustration shows the similarities between the two kinds of aurora. Both planets generate magnetic fields that capture charged particles.



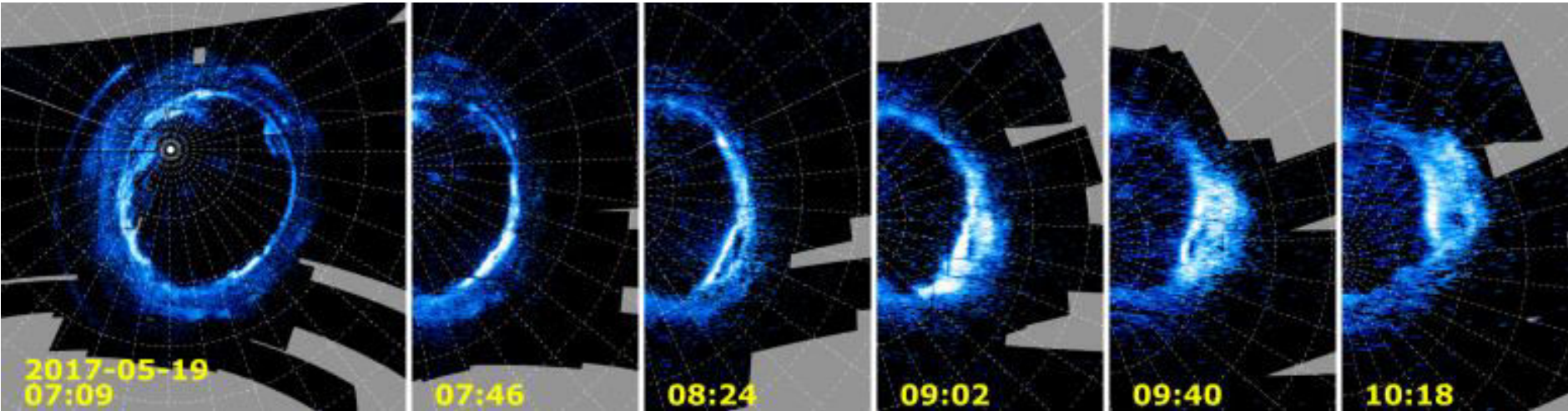


A new study tracks the life cycle of the spectacular ultraviolet storms in the big planet's aurora, generated by **charged particles from its volcanic moon, Io.**

The storms, which consist of brightenings and broadenings of the **dawn flank of an oval of auroral activity** that encircles Jupiter's poles, evolve in a pattern surprisingly reminiscent of familiar surges in the aurora that undulate across Earth's polar skies, called **auroral substorms.**

The new study is the first to track the storms from their birth on the nightside of the giant planet through their full evolution.

- During a **dawn storm**, Jupiter's quiet and regular auroral arc transforms into a complex and intensely bright auroral feature.
- It emits hundreds to thousands of Gigawatts of ultraviolet light into space as it rotates from the night side to the dawn side and ultimately to the day side of the planet over the course of 5-10 hours.
- A Gigawatt is the power produced by a typical modern nuclear reactor. This colossal brightness implies that at least ten times more energy was transferred from the magnetosphere to the upper atmosphere of Jupiter.



- Previously, dawn storms had only been observed from ground-based telescopes on Earth or the Hubble Space Telescope, which can only offer side views of the aurora and cannot see the night side of the planet.
- Juno revolves around Jupiter every 53 days along a highly elongated orbit that brings it right above the poles every orbit.

POLAR AURORAS REFLECT WHAT HAPPENS



- Earth's magnetosphere is shaped by charged particles flowing out of the sun called the solar wind. Bursts of solar wind stretch Earth's magnetic field into a long tail on the nightside of the planet. When that tail snaps back, it fires charged particles into the nightside ionosphere, which appear as spectacular auroral light shows.
- The new study found the timing of the dawn storms on Jupiter did not correlate with solar wind fluctuations. Jupiter's magnetosphere is mostly populated by particles escaping from its volcanic moon Io, which then get ionized and trapped around the planet by its magnetic field.



- The sources of mass and energy fundamentally differ between these two magnetospheres, leading to auroras that usually look quite different. However, the dawn storms, as unraveled by Juno's ultraviolet spectrograph, looked familiar to the researchers.
- The substorms result from the explosive reconfiguration of the tail of the magnetosphere.
- On Earth, they are strongly related to the variations of the solar wind and of the orientation of the interplanetary magnetic field. On Jupiter, such explosive reconfigurations are rather related to an overspill of the plasma originating from Io.

- These findings demonstrate that, whatever their sources, particles and energy do not always circulate smoothly in planetary magnetospheres.
- They often accumulate until the magnetospheres collapse and generate substorm-like responses in the planetary aurorae.
- Substorms result from brief disturbances in the Earth's magnetosphere – the region of space controlled by the planet's magnetic field – that release energy high into the planet's ionosphere.

- The similarity between terrestrial and Jovian substorms is surprising because the magnetospheres of Jupiter and Earth are radically different.
- On Earth, the magnetosphere is essentially controlled by the interaction of the solar wind – the stream of charged particles flowing from the Sun – with Earth's magnetic field. Jupiter's magnetosphere is mostly populated by particles escaping from the volcanic moon Io, which then get ionized and trapped around the gas giant via its magnetic field.
- These new findings will allow scientists to further study the differences and similarities driving the formation of aurora, providing a better understanding how these most beautiful of planetary phenomena occur on worlds both within our solar system and beyond.

Thank you 🌞

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