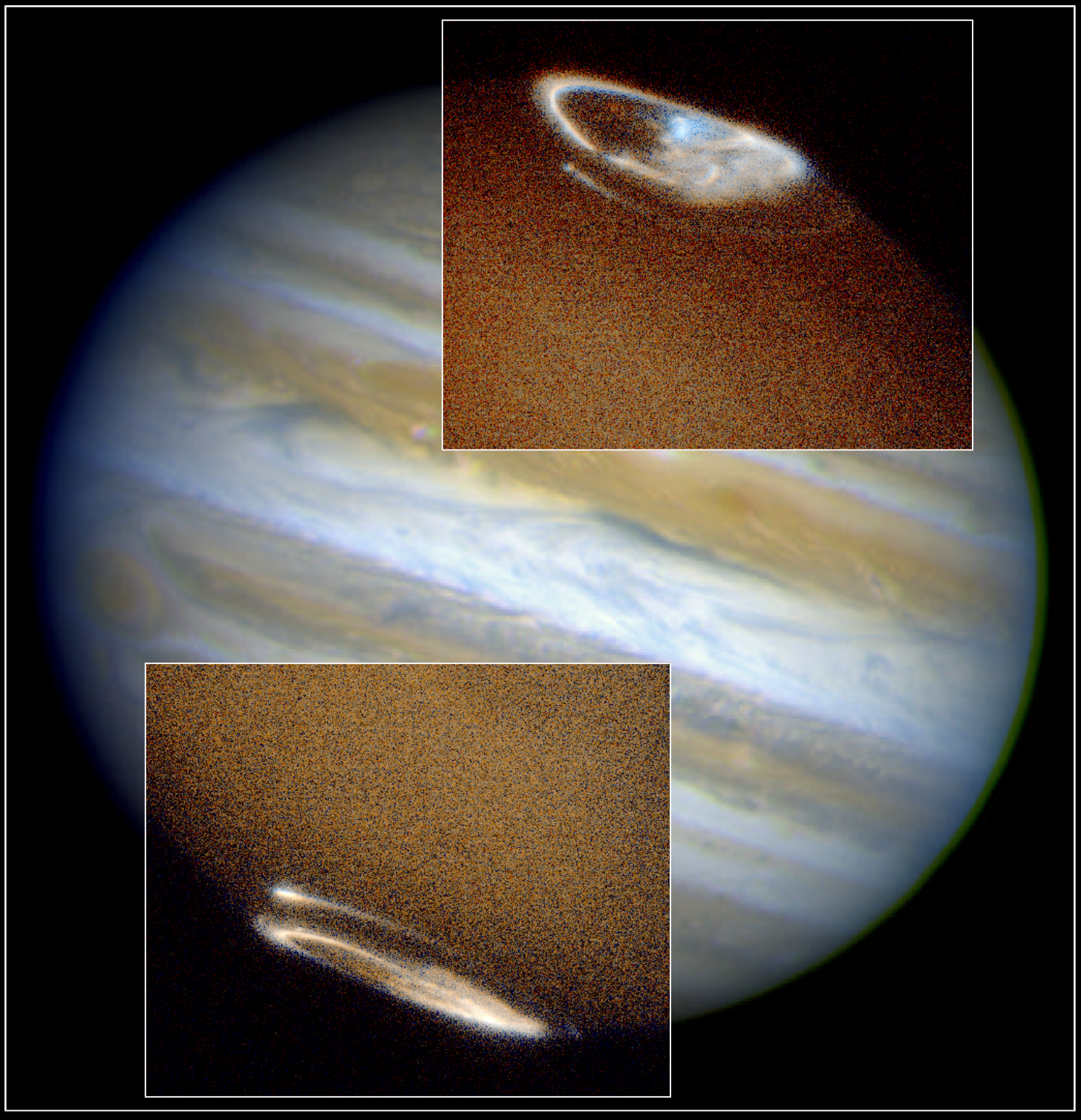

# Jupiter Aurora

## Hubble Space Telescope • STIS • WFPC2

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Hubble Space Telescope
NEWS

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# HUBBLE PROVIDES COMPLETE VIEW OF JUPITER'SAURORAS

NASA's Hubble Space Telescope has captured a complete view of Jupiter's northern and southern auroras.

Images taken in ultraviolet light by the Space Telescope Imaging Spectrograph (STIS) show both auroras, the oval-shaped objects in the inset photos. While the Hubble telescope has obtained images of Jupiter's northern and southern lights since 1990, the new STIS instrument is 10 times more sensitive than earlier cameras. This allows for short exposures, reducing the blurring of the image caused by Jupiter's rotation and providing two to five times higher resolution than earlier cameras. The resolution in these images is sufficient to show the "curtain" of auroral light extending several hundred miles above Jupiter's limb (edge). Images of Earth's auroral curtains, taken from the space shuttle, have a similar appearance. Jupiter's auroral images are superimposed on a Wide Field and Planetary Camera 2 image of the entire planet. The auroras are brilliant curtains of light in Jupiter's upper atmosphere. Jovian auroral storms, like Earth's, develop when electrically charged particles trapped in the magnetic field surrounding the planet spiral inward at high energies toward the north and south magnetic poles. When these particles hit the upper atmosphere, they excite atoms and molecules there, causing them to glow (the same process acting in street lights).

The electrons that strike Earth's atmosphere come from the sun, and the auroral lights remain concentrated above the night sky in response to the "solar wind," as Earth rotates underneath. Earth's auroras exhibit storms that extend to lower latitudes in response to solar activity, which can be easily seen from the northern U. S. But Jupiter's auroras are caused by particles spewed out by volcanoes on Io, one of Jupiter's moons. These charged particles are then magnetically trapped and begin to rotate with Jupiter, producing ovals of auroral light centered on Jupiter's magnetic poles in both the day and night skies. Scientists are comparing the Hubble telescope images with measurements taken by NASA's Galileo spacecraft of Jupiter's magnetic field and co-rotating charged particles. They believe the data will help them understand the production of Jupiter's auroras.

Both auroras clearly show vapor trails of light left by Io. These vapor trails are the white, comet-shaped streaks just outside both auroral ovals. These streaks are not part of the auroral ovals. They are caused when an invisible electrical current of charged particles (equal to about 1 million amperes), ejected from Io, flow along Jupiter's magnetic field lines to the planets north and south magnetic poles. This enormous current produces a bright but localized aurora where it enters Jupiter's atmosphere at both magnetic poles. The brightest part of both emissions (on the left in both images) pinpoints where Io's magnetic field lines leave its footprint on the planet. The trail of light following both emissions extends to the right all the way to Jupiter's edge and represents the most sensitive detection of ultraviolet emissions from Jupiter to date. These emissions are related to magnetically trapped ions and electrons that are carried by Jupiter's magnetic field along Io's orbital path, and some of these charged particles continue to be driven down into Jupiter's atmosphere for several hours after Io has passed by.

The images were taken Sept. 20, 1997. The artificial colors used here have been constructed by combining images taken in two different ultraviolet band passes, with one ultraviolet color presented as blue and the other as red. In this color representation, the planet's reflected sunlight appears brown, while the auroral emissions appear white or shades of blue or red.

Credits: John Clarke, University of Michigan, and NASA

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