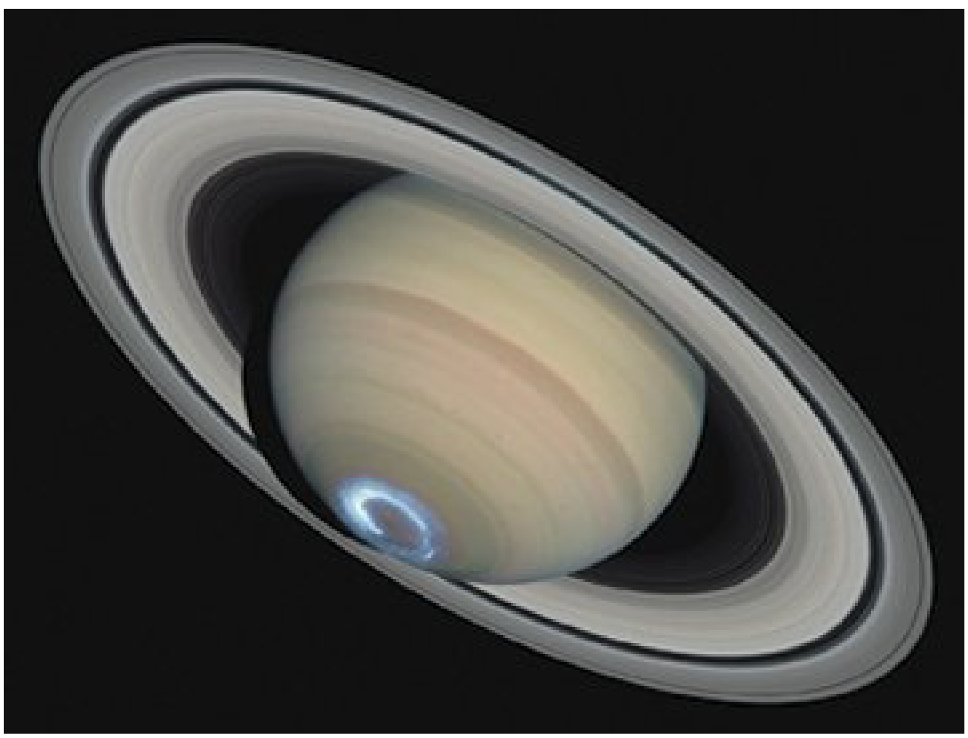
SCIENCE NEWS Online
THE WEEKLY NEWSMAGAZINE OF SCIENCE
Week of Feb. 19, 2005; Vol. 167, No. 8 , p. 116

Spying Saturn's Light Show: Anomalous aurora dazzles scientists

Ron Cowen

Among the solar system's auroras, the dancing lights that paint Saturn's skies show a distinct style.

Three reports in the Feb. 17 *Nature* describe a choreographed experiment conducted 13 months ago, in which the Earth-orbiting Hubble Space Telescope and the Cassini spacecraft, then en route to Saturn, both examined Saturn's south pole. Hubble took ultraviolet pictures of Saturn's auroras while Cassini recorded radio emissions from the same regions of the planet. Cassini also measured the solar wind, the flow of charged particles from the sun.



RING AND FIRE. Ultraviolet emissions from an aurora at Saturn's south pole, recorded by a Hubble detector, are superimposed on a visible-light image of the planet.
Clarke, *et al*., NASA, STScI

The measurements provide the most accurate glimpses yet of Saturn's auroras, says John Clarke of Boston University, a coauthor on all three studies.

Auroras, such as Earth's northern lights, arise when charged particles from space strike a planet's magnetosphere, the bubble-shaped region defined by a planet's magnetic field. Particles streaming into the upper atmosphere collide with atoms and molecules there and produce flashes of radiation ranging from ultraviolet to radio wavelengths.

Scientists have made detailed observations of auroras only on Earth, Jupiter, and now Saturn. Earth's auroras are driven by charged particles from the solar wind. The particles driving Jupiter's auroras come from gases spewed by that planet's volcanically active moon Io. On Saturn, auroras might arise either from the solar wind or from material evaporating from a moon.

Even though there are similarities among the different planets' auroras, Saturn's stand out in several ways.

Following an outburst from the sun, Saturn's auroras become brighter, as do auroras on Earth. But on Saturn, the intensifying light then shrinks, becoming confined to high latitudes. On Earth, in contrast, strong auroras tend to expand to lower latitudes. Auroras on Jupiter remain relatively constant in both intensity and extent.

Frank Crary of the Southwest Research Institute in San Antonio and his colleagues found that Saturn's auroras strengthened in response to increased pressure from the solar wind but not to the alignment of the wind's magnetic field. On Earth, auroral activity is strongest when the solar wind's magnetic field opposes that of the planet.

Saturn's auroras also differ from Earth's in that they become brighter on the sector of the planet where night is turning to day. On Earth, it's just the opposite—the aurora appears brighter where day is turning to night.

Saturn's auroras also have their own shape. On Earth and Jupiter, auroras form a ring, but on Saturn they often appear as a spiral.

Theorist Stan Cowley of the University of Leicester in England has modeled the aurora's spiral-forming process and suggests that the shape is triggered by sudden gusts of solar wind. In his model, these gusts liberate gas from one side of Saturn's magnetosphere, and the gas is then swept up and heated by Saturn's rapid rotation to form the glowing spiral.

Cassini entered orbit about Saturn last summer, about the same time that

Hubble's main ultraviolet detector failed. This week, Cassini researchers plan to reexamine the planet's aurora by coordinating observations with another detector on Hubble.

If you have a comment on this article that you would like considered for publication in *Science News*, send it to editors@sciencenews.org. Please include your name and location.

References and sources for this article

References:

Clarke, J.T. . . . F. Crary . . . S.W.H. Cowley, *et al*. 2005. Morphological differences between Saturn's ultraviolet aurorae and those of Earth and Jupiter. *Nature* 433(Feb. 17):717-719. Abstract available at http://dx.doi.org/10.1038/nature03331.

Crary, F.J., J.T. Clarke, *et al*. 2005. Solar wind dynamic pressure and electric field as the main factors controlling Saturn's aurorae. *Nature* 433 (Feb. 17):720-722. Abstract available at http://dx.doi.org/10.1038/nature03333.

Kurth, W.S. . . . J.T. Clarke . . . and F.J. Crary. 2005. An Earth-like correspondence between Saturn's auroral features and radio emission. *Nature* 433(Feb. 17):722-725. Abstract available at http://dx.doi.org/10.1038/nature03334.

Further Readings:

Bagenal, F. 2005. Planetary science: Saturn's mixed magnetosphere. *Nature* 433(Feb. 17):695-696.

Sources:

John T. Clarke
Boston University
725 Commonwealth Avenue
Boston, MA 02215

Stanley W.H. Cowley
Department of Physics and Astronomy

University of Leicester
Leicester LE1 7RH
United Kingdom

Frank J. Crary
Southwest Research Institute
Culebra Road
San Antonio, TX 78288

From Science News, Vol. 167, No. 8, Feb. 19, 2005, p. 116.