Uranus: Signs of a magnetic field?

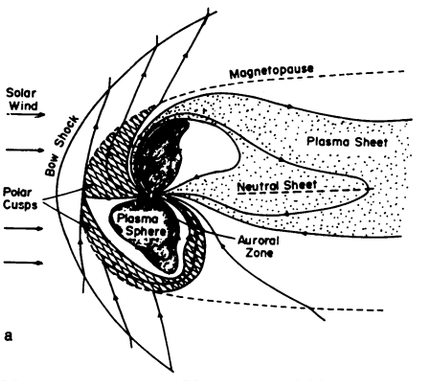
A major key in the study of other worlds lies in establishing the presence or absence of their magnetic fields. Besides contributing to radio emissions, trapped radiation belts and other overtly electromagnetic phenomena, a planet's magnetic field has implications for its interior and even its atmosphere. Jupiter's field was revealed in the 1950s when radio-astronomers detected its powerful radio bursts, but the other worlds with confirmed fields have depended for the knowledge on visiting spacecraft.

Now there are two reports of evidence that may represent a magnetic field at Uranus, roughly four times as distant as Jupiter and to which no spacecraft has ever been (although Voyager 2 will get there early in 1986). The only previous hint was the finding several years ago that data from the earth-orbiting IMP-6 satellite seemed to be showing a few radio bursts to have come from Uranus's direction (SN: 8/7/76, p. 86). But the analysis identified only six brief bursts out of about 500 *days* of data, and even its author described the conclusion as "very iffy."

The new evidence comes from the International Ultraviolet Explorer, a U.S.-European astronomy satellite among whose subjects has been the UV light of Uranus's hydrogen Lyman alpha (Lyα) emissions. And it seems to be a bright light indeed — so bright that it requires some explaining.

One expected source of Lyα emission is the scattering of the sun's UV light by the hydrogen atoms at the top of a planet's atmosphere, with the brightness of the emission commonly taken as an indicator of the amount of atomic hydrogen present. Using a March 3 observation of Uranus by the satellite, Samuel T. Durrance and H. Warren Moos of Johns Hopkins University calculate that its disk-averaged brightness was 1.6 ± 0.4 kilorayleighs. The problem, according to the scientists, is that for such a brightness to be produced solely by the scattering of sunlight would require a column density of hydrogen (above the UV-absorbing methane that is farther down in the atmosphere) at least 10 times greater than that of Jupiter. Furthermore, because Uranus is so much farther from the sun, the amount of solar UV available to produce atomic hydrogen (H) from molecular hydrogen (H_2) is only one-fourteenth of what it is at Jupiter. Such an abundance of H is not inconceivable, the researchers note, but it would require the normal eddy-diffusion processes that cycle the H out of circulation to be 100 times weaker than in Jupiter's case.

There could be another source of such a bright emission, however: an aurora, such as are already well-known on earth, Jupiter and Saturn. And that would mean a magnetic field. In an aurora, charged particles on the field lines are accelerated down into the upper atmosphere, colliding with hydrogen atoms and molecules alike. The atoms are "excited" by the collisions, producing Lyα emissions, while the molecules are dissociated into excited atoms that do the same thing.



G. Siscoe/Icarus

Magnetosphere of Uranus could be unique in the solar system, since the planet's axis lies almost in the ecliptic plane and currently points almost directly toward the sun.

The case is not ironclad, though Durrance finds it at least "very strong evidence" of an aurora, and thus of a magnetic field. But there is another clue. The Lyα brightness of reflected sunlight is believed to be a relatively stable phenomenon, varying by perhaps 10 percent, while that of an aurora is highly changeable. John T. Clarke of the University of California at Berkeley has used the same satellite to observe Uranus on four separate occasions, and between the first two times — April 21 and 23, a mere two-day span — the brightness doubled. (On June 19 and 20, it had receded to a level about midway between the first two readings.) Late last month, on Aug. 21, Durrance and Moos made yet another observation, and are now reducing the data to see if their two observations also show a significant change.

The "definitive proof, says Durrance, would be the detection of emissions from H_2, which would signal the presence of energetic magnetospheric particles. The Hopkins group is pursuing the idea.

— *J. Eberhart*

Will panda bear? Probably not this year

There's still the tiniest glimmer of hope amidst general disappointment in the panda department at the National Zoo in Washington, D.C. "We are not going to have a baby panda unless Ling-Ling sets a new record for length of pregnancy," zoo director Theodore Reed announced last Friday. "To say I am bitterly disappointed is an understatement."

But on Saturday panda Ling-Ling once again displayed a behavior associated with pregnancy, so as a precautionary measure the zoo extended the round-the-clock birth watch by staff and volunteers. The watch had been scheduled to end Monday, August 30, 163 days since insemination. The lengths of reported panda pregnancies range from 122 to 163 days.

Ling-Ling has been a source of frustration to the zoo. This year was the sixth attempt to have her bear a cub. "This year we were the most optimistic," Reed says. After Ling-Ling failed to mate with the zoo's male panda Tsing-Tsing, she was artificially inseminated. The operation went well and early in August she began some behaviors observed in other pandas prior to giving birth. She carried pieces of bamboo to two possible nesting places, licked her genitals, defecated frequently and ate less than usual. In addition, levels of three hormones went up. Because an adult panda is 250 pounds and a cub only 4 ounces, pregnancy is not obvious in the mother's figure.

The National Zoo's optimism was short-lived. By late August Ling-Ling's hormone levels were down and she had stopped displaying the suggestive behaviors. Devra Kleiman, chief of zoological research, says, "We think we were dealing with a false pregnancy." Because the observers never saw nipple development or swelling and reddening of the vulva, Kleiman does not think it was a case of an unsuccessful pregnancy. There has been one other reported case of false pregnancy in a zoo panda. About thirty panda cubs have been born in captivity.


Cohen/National Zoo

Ling-Ling

But Ling-Ling foiled even the zoo's plan to give up hope. The day after Reed announced the birth watch would be discontinued, the panda was observed licking her genitals again. Although they have little hope now that Ling-Ling will have a cub this year, zoo officials decided to extend the watch one more week. But then they plan to turn their thoughts to next year. "We'll never quit trying," Reed says. Kleiman estimates 12-year-old Ling-Ling has six more years for potential cub-bearing.

—*J.A. Miller*