Keck telescope captures faint new ring around Uranus

December 22 2005

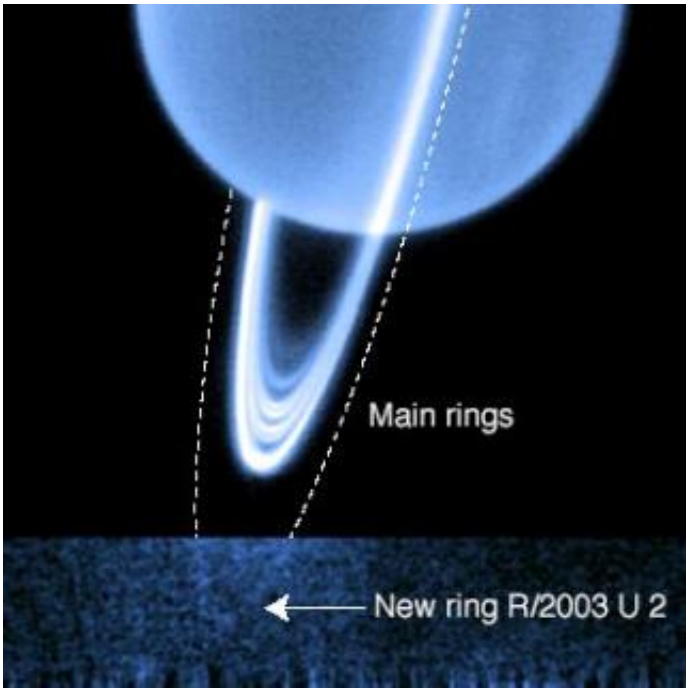

Image: The dashed line indicates the position of the innermost of two new rings discovered recently by the Hubble Space Telescope and confirmed by ground based observations with the Keck II Telescope in Hawaii. The previously known ring system is shown lying within the new ring, while the lower panel shows an enhanced image of the faint ring as captured in infrared by Keck. A second new ring was found by Hubble outside this ring, but was not detected by Keck, indicating that the outermost ring is bluer and probably contains smaller dust grains than the inner ring. (Credit: I. de Pater, H. B. Hammel, S. Gibbard [UC Berkeley] and M. Showalter [SETI Inst.])

Astronomers have made the first ground-based observations of one of two new rings discovered recently around the planet Uranus by the Hubble Space Telescope and announced today.

The ground-based detection was conducted with the Near Infrared Camera (NIRC2) using the adaptive optics system on the Keck II telescope atop the Mauna Kea volcano in Hawaii.

The new discoveries within the Uranus ring system are being made thanks to the superb instrumentation that researchers are now using on both the Keck and Hubble telescopes, and because of the current angle of Uranus' rings as seen from Earth, according to Imke de Pater, a professor of astronomy at the University of California, Berkeley, and leader of the ring science Keck observing team.

De Pater explained that our perspective on the planet's rings changes as Uranus and Earth orbit the sun. The rings are now "closing up" and in 2007 will appear edge-on from Earth, providing astronomers with an opportunity to see faint rings. The path lengths through the dusty rings increase as the rings close up, so that any faint rings will become progressively more visible.

De Pater, Heidi B. Hammel of the Space Science Institute in Boulder, Colo., and Seran Gibbard of Lawrence Livermore National Laboratory, announced their observations of the innermost new ring today in a circular issued by the International Astronomical Union (IAU). The initial discovery of Uranus' two new rings was announced in the same IAU circular, issued Dec. 22, and will appear in the Dec. 23 issue of the journal Science. Authors of that report are Mark R. Showalter of the SETI Institute and Jack J. Lissauer of the NASA Ames Research Center, both located in Mountain View, Calif.

"We have been puzzled by the fact that we cannot detect the outer ring,

even though it is more than twice as bright as the inner ring in the Hubble data," de Pater said. "The difference is probably caused by the fact that we are working in the infrared, at a wavelength four times longer than that used by the Hubble telescope in the rings' discoveries. This seems to suggest a color difference between the two rings, which would indicate that their constituent particles are very different."

Specifically, the team concludes, the outer ring is much less red, which would suggest it is made of tinier particles. This would be consistent with the hypothesis by Showalter and Lissauer that the inner ring may have a large population of unseen source bodies, whereas the outer ring may be composed entirely of dust ejected from Uranus' tiny moon, Mab.

"A normal dusty ring is red," said de Pater, noting that Jupiter's rings and Saturn's G ring are distinctly red. Only Saturn's E ring, nearest to the moon Enceladus, is blue.

"If a ring has a lot of tiny particles, it will be bluer, because smaller particles do not scatter efficiently in the red," added Gibbard.

"Because our team was observing in the near infrared - an invisible part of the spectrum with wavelengths longer than that of visible red light - we concluded that the outermost ring must be more neutral in color than the innermost ring," Hammel explained.

The new discoveries by Showalter and Lissauer, made in visible light with Hubble's Advanced Camera for Surveys, are faint, dusty rings orbiting well beyond Uranus's previously known system of 11 distinct rings. This brings the total number of known rings up to 13. Uranus also has 27 known moons, one of which, Mab, seems associated with the outermost new ring.

When the Keck team was first informed of the discovery a few months

ago, de Pater carefully processed data they had obtained in August with the infrared camera on the 10-meter Keck II telescope. After combining 30 images (equal to a full hour of integration time), she spotted the innermost of the two new faint rings. In subsequent observations in October, the team specifically looked farther from the planet, but failed to see the outermost of the two new rings.

The innermost new ring is about 67,700 kilometers from Uranus, just outside the previously known outermost and brightest ring, called the epsilon ring. This is in accord with the NASA team's results - that the peak brightness of the innermost new ring is 67,300 kilometers from the center of the planet. The outermost ring, which de Pater and her team did not see, was reported to have a peak brightness at 97,700 kilometers from the planet's center.

De Pater, Hammel and Gibbard have been observing the planet since 2000 with the second-generation NIRC2 using the adaptive optics system on the Keck II telescope. Last year, they spotted an inner ring, the 11th, that was seen only once before by the Voyager spacecraft.

The team has uncovered various other interesting aspects of the Uranian rings. They saw, for example, that faint dust sheets in between the main rings do not have the same spatial brightness distribution as the dust seen by the Voyager spacecraft almost 20 years earlier in forward scattered visible light. These results have just been published in the Jan. 2006 issue of Icarus.

De Pater's research is supported by the National Science Foundation and the Technology Center for Adaptive Optics at UC Santa Cruz. Hammel is supported by the National Aeronautics and Space Administration (NASA), while Gibbard is supported by the U.S. Department of Energy's National Nuclear Security Administration.

Source: UC Berkeley