

Belt of Satellites Discovered Around Uranus

Apparent signs of "a whole belt of satellites"—perhaps as many as 18 previously unknown moons—around the planet Uranus were observed late last week by at least two separate groups of astronomers. Evidence appears to indicate that the observed objects are just a part of a system of rings circling Uranus. The signs appeared during observations mounted to study the passage of Uranus between the earth and a bright star, an event so rare that teams were sent to watch it from widely spread locations around the earth.

Such passages, or occultations, are important because timing of the star's disappearance and emergence from behind the planet can provide extremely precise measurements of the length of the star's track across the planetary disk. Measurements from several locations can be combined to yield the planet's size and shape. Instead of taking photographs, astronomers use their telescopes simply to chart the brightness of the star, noting the times when it essentially blinks off and on at the beginning and end of the occultation.

Last week's startling results were in the form of several brief, unexpected additional "blinks" before and after the principal blackout. "The first one we saw, we thought we'd lost tracking," says James L. Elliot of Cornell University, "and that Uranus had gone out of the aperture or something." Elliot was observing from the National Aeronautics and Space Administration's Kuiper Airborne Observatory, a C-141 jet equipped with a telescope and other instrumentation, flying over the southern Indian Ocean. "Then there became more of them, and then we saw them on all of our channels at the same level." (Elliot's observations were made at the 6200-, 7300- and 8500-angstrom methane bands.) Faced with an exciting possibility, he and his colleagues elected to extend the observation time to the corresponding distance past the disk of Uranus, "and they appeared there, so by then we were just about completely convinced."

About half a dozen dips in the "light curve" showed up on either side of the disk. Robert Millis of Lowell Observatory, observing at Australia's Perth Observatory for the occasion, found a similar number before the main occultation time as seen from his viewing position. Perth is located far from where the aircraft was, and it turned out to be outside the track of Uranus's occultation, so the fact that Perth missed the planet but did see the preceding little occultations suggests that they may represent different objects than those seen from the aircraft.

The objects seem to be smaller than

most known solar system satellites, but larger than the prevailing opinion of the size of the chunks in Saturn's rings. "We have two or three ones that are between 30 and 100 kilometers, if you interpret [the angle subtended by the occultation tracks] in terms of diameter," says Elliot of the airborne data, "and then there are others that are smaller. Some of the events aren't total occultations—they're just transits—so these things must be sort of grazing the star."

At least one additional observation was reported from India. Using the 122-centimeter reflector at Kavalur, India, J. C. Bhattacharyya and colleagues observed an occultation that corresponds to a 100-kilometer-size body near the outer edge of the belt, according to Brian G. Marsden of the Smithsonian Astrophysical Observatory.

There was some uncertainty beforehand about the precise geometry of the main occultation—a recalculation caused one team to shift its planned observing site from India to Mauritius—but the result was serendipitous. "You might say that it was because the predictions of the event were so uncertain that we did see them," Elliot says, "because normally you just try to be very efficient and start observing about 15 minutes before the event, and when you see the thing is over you turn it off." Fortunately, the equipment was turned on early to be on the safe side.

The brief occultations before Uranus itself spanned a total of about 9 minutes in Elliot's data, ending about 33 minutes before the planet's own. The timing on the outbound portion was similar. Elliot estimates that the inner edge of the "belt," as observed, is about 40,000 kilometers from the center of Uranus. This is 11,000 to 15,000 kilometers from the limb, depending upon the planet's radius (which should be determined with record accuracy from the main occultation).

Subsequent calculations by Marsden over the weekend refined the belt's distance somewhat. Marsden comes up with

44,000 kilometers for the inner radius of the belt and 51,000 kilometers for the outer radius.

Marsden finds it very probable that the satellites are in the plane of Uranus's equator. And the indications are that the belt is basically circular.

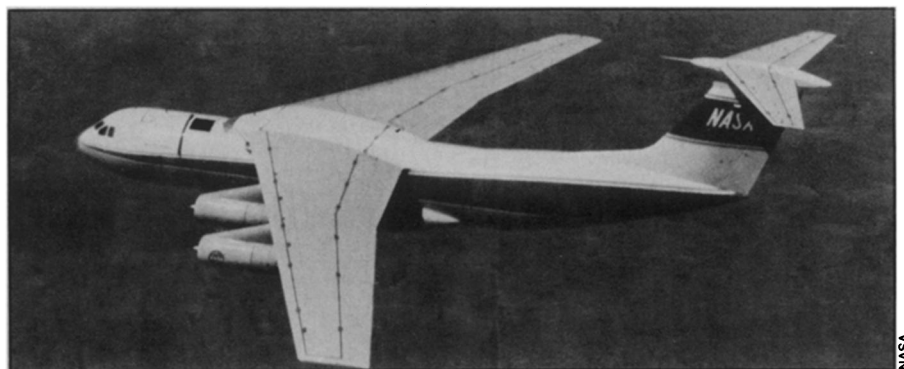
Uranus was previously known to have five satellites, ranging in diameter from 550 to 1,800 kilometers. The largest two, Titania and Oberon, were discovered by William Herschel in 1787, and the next two, Ariel and Umbriel, were discovered by William Lassell in 1851. The smallest of the five, Miranda, was discovered by Gerard Kuiper in 1948.

The newly discovered belt of satellites is well inside the orbits of the original five, which are at mean distances ranging from 128,000 to 587,000 kilometers.

The new discovery does not mean that Elliot, Millis and others are suddenly faced with a cluster of new satellites to name. That will have to wait until it is possible to determine their orbits. The task of recording the objects—if objects they are—on photographic plates is a difficult one. But perhaps not impossible: "We don't have the facilities to do it," says Elliot, "but they'd be about a second of arc from the limb and they're going to be faint, and possibly with taking photographs in deep methane bands, someone may find them."

Elliot was not exactly jumping up and down as he spoke with SCIENCE NEWS from his Perth hotel room less than 24 hours after the flying observatory landed. It was 5:30 in the morning as he prepared to leave for Melbourne, but the excitement was with him. "I think," he said, "this is a sort of unique thing."

That may prove grand understatement. Assuming that objects like those so far discovered are distributed in the same abundance around the entire circumference of the belt, Marsden concludes: "In the tens of kilometers size range, there may be several thousand objects in orbit around Uranus." □



Blinks due to belt of moons around Uranus were sighted from airborne observatory.