PLANETARY SCIENCE

Saturn Wins Satellite Title With New Moons

This week an international team of astronomers announced the discovery of four new moons of Saturn, restoring the ringed planet to its status as commander of the largest retinue of satellites in the solar system. Their appearance should help researchers understand not just how the new moons were formed but also how the giant planets themselves came to be.

At this week's meeting of the Division for Planetary Sciences in Pasadena, California, astronomer Brett Gladman of the Observatory of Nice and seven colleagues reported that state-of-the-art light detectors (see following story) revealed four bodies 10 to 50 kilometers in diameter that "almost certainly" are orbiting Saturn. That makes a total of 22, surpassing Uranus's 21.

Although their orbits have not been determined yet, the new moons are probably "irregular" satellites. Whereas most major satellites form from dust and gas orbiting a planet, irregulars are outsiders captured by a planet into distant, inclined, and sometimes highly elongated orbits.

Two groups of four irregular moons orbit Jupiter in opposite directions. Astronomers take that arrangement as a sign that two large bodies approached a still-growing Jupiter, broke into pieces, and went into orbit. With four more examples to study, astronomers may be able to choose between two theories of how precursors of irregular satellites were captured. One model involves close encounters or even collisions with existing moons; the second points to drag from the last wisps of gas accreting to a new planet.

–RICHARD A. KERR

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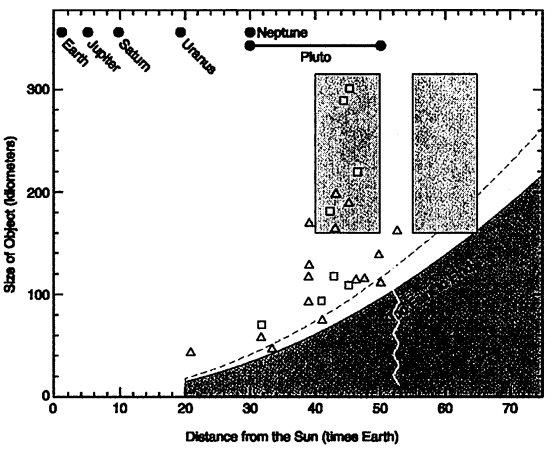
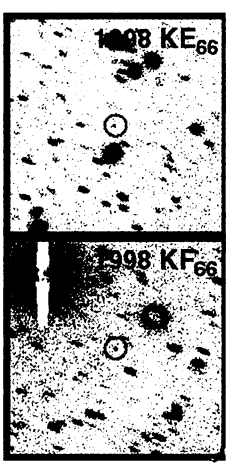
Solar System Scientists Look to Find an Edge

The universe may go on forever, with no end or edge in sight, but our solar system is hardly so expansive. For several years, ever-improving telescope technology has allowed astronomers to peer farther and farther beyond Neptune to discover a rapidly increasing number of bodies littering the outer reaches of the solar system. Now many researchers agree that an end is in sight, although some remain skeptical.

A report this week at the annual Division for Planetary Sciences (DPS) meeting in Pasadena, California, places the limit just beyond little Pluto's farthest wanderings, about 50 times Earth's distance from the sun (50 astronomical units or AU). Although some objects that originally formed in the solar system at its birth 4.5 billion years ago have been flung beyond that point, astronomers can see none beyond the 50-AU limit still hanging around their birthplace. An edge there would be far closer than predicted by conventional theories of solar system formation, suggesting that our planetary system started out surprisingly small or something ripped away the outer parts of the nascent solar system.

The solar system "really stops beyond Neptune" and the chunk of primordial debris called Pluto, says astronomer Brian Marsden of the Harvard-Smithsonian Center for Astrophysics in Cambridge, Massachusetts. "A lot of us have concluded that"—a lot, but not everyone. "This is a tricky game," says astronomer Brett Gladman of the Observatory of Nice. "When I look at our data, I don't think there's any real evidence for an edge" beyond which there is little or no detectable material. Although researchers gather their evidence for an edge from their own deep telescopic surveys, proof may have to await a close comparison of existing surveys, possibly in the next year.





No-shows. A telescopic search found new objects *(right)* beyond Neptune but not as far out as it could have (empty box, *above*).

SOURCE: L. ALLEN *ET AL.*

Putting a close-in edge on the solar system would have more than merely territorial implications. The extent of the Kuiper belt, a disk of bodies left over from the primordial gas, ice, and dust that agglomerated to form the planets, can provide hints of how the planets came together. An edge at 50 or 55 AU would mean the original preplanetary disk was far smaller than those of young stars seen today, or that something—perhaps a too-close encounter with another newly formed star—tore away much of the disk.

Proponents of an edge place it at the apparent outer limit of today's Kuiper belt. The young giant planets Jupiter, Saturn, Uranus, and Neptune gravitationally tossed great balls of primordial stuff far outward, where they formed the Oort cloud tens of thousands of AU from the sun. Nevertheless, 4.5 billion years later, upward of 100,000 objects at least 100 kilometers in diameter still orbit in the Kuiper belt beyond Neptune, according to extrapolations from telescopic surveys.

Just how far Kuiper belt objects (KBOs) extend beyond Neptune has long been a mystery. But in the past decade astronomers have used larger versions of their workhorse light detector—the charge-coupled device—and assembled them into large mosaics. With these far more capable CCDs, planetary astronomers are detecting fainter and fainter objects while surveying larger parts of the sky.

Until recently, over 300 KBOs had been found, but none much more distant than about 50 AU. At the DPS meeting, astronomers Lynne Allen and Gary Bernstein of the University of Michigan, Ann Arbor, and planetary dynamicist Renu Malhotra of the University of Arizona in Tucson reported that their state-of-the-art survey has discovered 24 new KBOs, but none was found beyond 53 AU even though their search was sensitive enough to find 160-kilometer objects out to 65 AU. And astronomers Chadwick Trujillo of the California Institute of Technology in Pasadena, David Jewitt of the University of Hawaii, Manoa, and Jane Luu of Leiden University in the Netherlands reported that their search over a much larger area for less-faint objects than Allen and colleagues could detect turned up 57 KBOs, none of which is beyond 50 AU. "It seems like there's an edge," says Trujillo. Allen agrees: "We see objects nearby, and we don't see anything far away."

That finding holds for other surveys, too, although Gladman cautions that looks could be deceiving. "I don't think the evidence is strong," he says about the new results. "It's very hard, because these objects become faint very fast with increasing distance. And the results depend on the assumptions used to model the data." Those assumptions may be spelled out in the next year, says Gladman, leaving astronomers in a better position to judge whether the solar system ends abruptly. –RICHARD A. KERR