The Rings of Uranus: News and Views

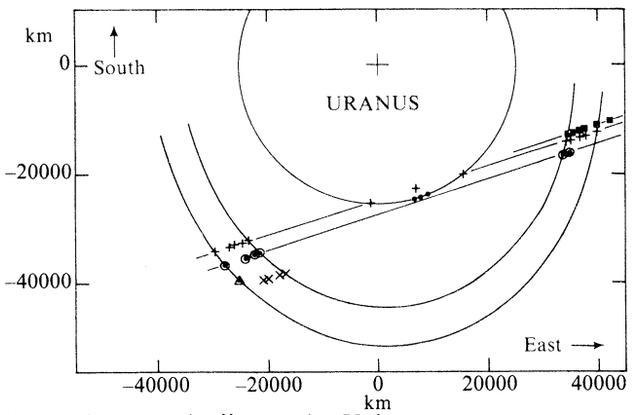
The completely unexpected discovery of what appear to be rings around the planet Uranus has produced as much excitement among astronomers and others as any solar-system find in recent years. The discovery took place on March 10, when observers in various parts of the world, waiting at their telescopes for a star to be blocked off or occulted by Uranus, saw the star first "blink on and off" several times and later repeat the trick after the planet had passed (SN: 3/19/77, p. 180). Since then, the original observers and others have been looking back through earlier data for possible signs of the rings' presence, and at the same time trying to understand what seems to be their surprising configuration.

Among the best photos ever taken of Uranus are a series made through a 91-centimeter telescope that was carried by a balloon to an altitude of about 24 kilometers in March 1970 as part of a project called Stratoscope II. The resulting images were processed (deconvolved) by the late Robert E. Danielson of Princeton, Martin G. Tomasko of the University of Arizona and B.D. Savage of the University of Wisconsin, and published in 1972 in the ASTROPHYSICAL JOURNAL (178:887). The researchers were looking for possible belts or other features on the planet itself, and had no idea that the rings might exist.

Now at least two other researchers, William Sinton of the University of Hawaii and Giuseppe Colombo of the University of Padua in Italy, believe that the deconvolved images show what may be the actual shadow of the rings on the planet. Danielson and his colleagues found only hints of the kinds of features they were then seeking, but, says Sinton, "it does appear . . . that the Stratoscope II photographs recorded the projection of the rings on the disk of Uranus."

Some other scientists who have also looked back at the Stratoscope photos are less certain that the ring-shadow is really there, as opposed to, say, an artifact of the image processing. Following the original discovery, several researchers felt that the planned orbiting Space Telescope, or even a visting spacecraft, might be necessary to make the extremely thin rings visible. The Stratoscope photos, however, are not the only ones that show promise.

Last year, several images of Uranus were made through the 61-inch telescope at the University of Arizona's Mt. Lemmon Observatory in the first formal astronomical application of a relatively new and extremely sensitive detector called a charge-coupled device, or CCD (SN: 3/12/77, p. 169). While the rings may or may not be there—at least they're



The inner and outer rings of Uranus, deduced from stellar occultations reported from the March 10 event by six groups of observers.

"down in the noise," says the University's Bradford Smith—the sensitivity of the CCD makes it possible to conclude that the ring particles must be very dark, with a reflectivity of only a few percent. If current estimates of the rings' density and widths are correct, Smith reports in NATURE (July 7), then the average reflectivity of the individual particles must be "much closer to that of carbonaceous chondritic material than to the ice-coated particles in the rings surrounding Saturn."

Furthermore, Smith has also rephotographed the planet with the CCD in 1977, using improved supporting electronics and longer exposures. It is too early to be sure, but a preliminary look at the new data suggests that this time the rings may actually have shown up.

Several researchers, meanwhile, have been combining data from the various observations of the March 10 occultation to improve estimates of the rings' shapes and positions. One striking conclusion, reported (also in the July 7 NATURE) by William B. Hubbard and colleagues from the University of Arizona, is that "neither the inner four rings nor the outer ["epsilon"] ring are truly concentric circles to within their widths." Since the time of Kepler, astronomers have been aware that the body around which other bodies revolve in circular orbits should be at the center of those orbits. The rings of Saturn, for example, are believed to be both circular and concentric. If the rings of Uranus are not concentric, then it would seem that all (or all but one) of them are elliptical, unless some other influence is affecting their motion and complicating the picture. Barring such influences, the different elliptical orbits of the individual particles should then be precessing around the planet at different rates. This ought to—but apparently doesn't—spread the particles out into a broad, more disklike pattern.

How much of a mystery is this? Theories are young yet, but it has been suggested that possible perturbing factors could include irregularities in the mass distribution of Uranus, or resonance effects of the planet's moons. The moons, in fact, also play the key role in the one published theory of the rings' origin. Stanley F. Dermott and Thomas Gold of Cornell University have proposed (in the June 16 NATURE) that the rings' structure could be explained by orbital resonances between the ring particles and the satellites Ariel, Titania and Oberon. □

Jupiter orbit mission survives House vote

Aided by a last-ditch lobbying effort by planetary scientists and others, a proposal to send a spacecraft to Jupiter with a probe to descend into the huge planet's atmosphere has survived an attempt to kill it by a House of Representatives subcommittee. In a remarkable show of support this week, the full House voted by 280 to 131 essentially to repudiate its own subcommittee, clearing the way to fund the $375 million mission.

The mission, known as the Jupiter Orbiter and Probe (JOP), is to be launched in early January of 1982, arriving at Jupiter in late November of 1984. The orbiter is to circle the planet for at least 20 months, making seven close passes by the huge moon Ganymede, four near Callisto, one near Io and possibly one near Europa. Early in the mission, the probe would be detached from the orbiter and sent down through the Jovian atmosphere, taking measurements to a depth equivalent to at least 10 times the earth's atmospheric pressure at sea level.

Numerous sources in and out of government maintain that the National Aeronautics and Space Administration was virtually unaware that the long-discussed mission faced any problems with Congress until it was cut from the fiscal 1978 NASA budget-appropriations bill by the House Appropriations Sub-