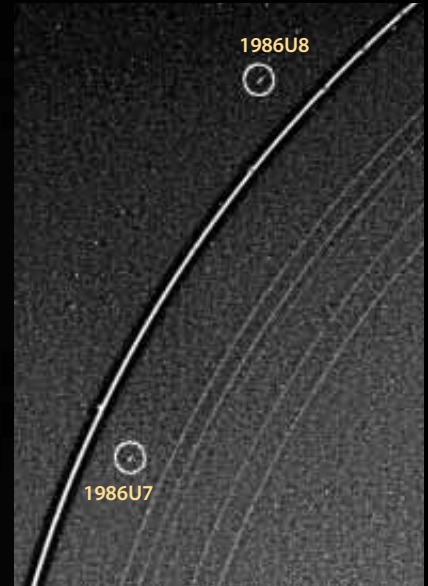
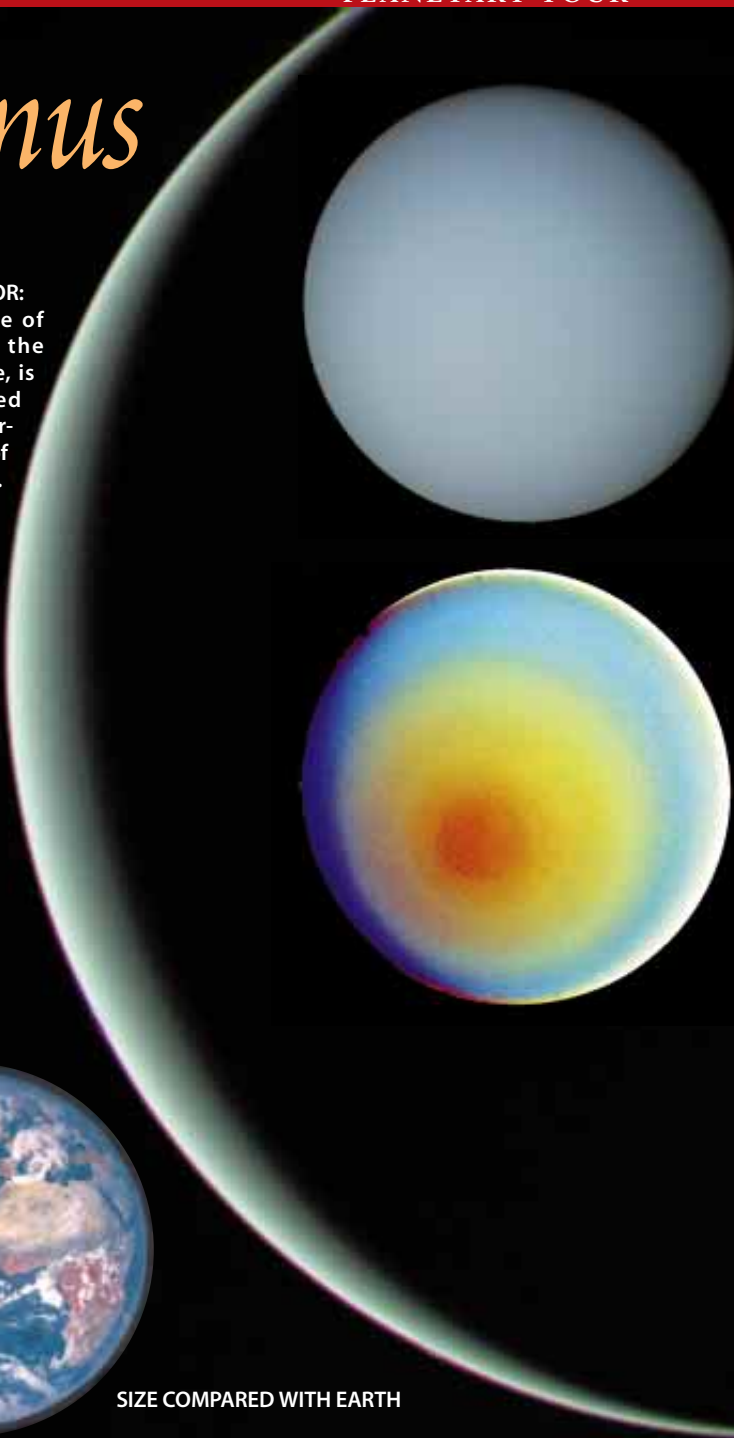


Uranus

TRUE AND FALSE COLOR: The placid blue face of Uranus, because of the presence of methane, is quite dull compared with the hectic and variable views we have of Jupiter and Saturn. But Voyager 2 did photograph the planet using ultraviolet, violet, blue, green and orange filters. These filters revealed more details, such as the mist, here in orange, covering the south pole.

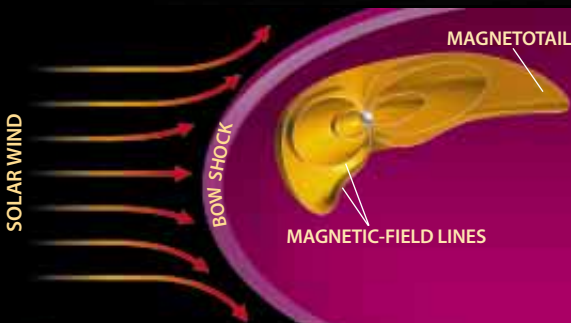


SIZE COMPARED WITH EARTH



SHEPHERD MOONS

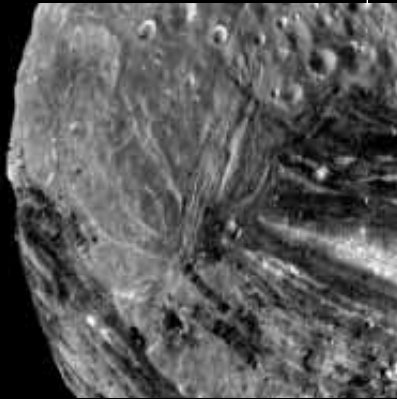
hem in the Epsilon ring through gravitational interactions from either side. The shepherds Ophelia (1986U8) and Cordelia (1986U7) were caught in the act by Voyager's camera (*above*). The Epsilon ring is the brightest and broadest of the nine rings, all clearly visible in the image (*right*) captured by Voyager from a distance of more than one million kilometers from the planet.



MAGNETOSPHERE OF URANUS is tilted 59 degrees from the rotation axis. In addition, the field is skewed, perhaps because its dynamo region is well off-center. In general, no planetary dynamo, including Earth's, has been convincingly explained.



JPL/CALTECH/NASA (top two views and background); ASTROGEOLOGY TEAM, U.S. GEOLOGICAL SURVEY; FL. AGSTAFF, ARIZ. (middle left); JPL (middle right); ANDREW CHRISTIE (bottom)



FIVE MAJOR MOONS

are mixtures of rock and ice. Ariel, Umbriel, Titania and Oberon have densities that indicate compositions of about three parts ice to two parts rock. Smaller Miranda, as well as the other 10 tiny moons, probably has a greater proportion of ice. The surfaces of Oberon and Umbriel are densely cratered. Titania and Ariel are in keeping with Oberon and Umbriel with respect to density of small craters, but they have far fewer larger craters, in the 50- to 100-kilometer (31- to 62-mile) range. These larger craters are probably older, leading astronomers to believe that Titania and Ariel have younger surfaces than Oberon and Umbriel, for reasons as yet unclear. All the moons have canyons that seem to reveal ancient spreading and fracturing of their surfaces because of expansions of 1 to 2 percent, with the exception of Miranda, which probably expanded more on the order of 6 percent. The expansions could be the result of the freezing of what was originally liquid water, but the presence of liquid water at any time on these moons still requires an explanation. Miranda's expansion scarred the surface with extensive networks of grooves and troughs (*above*) as well as deep canyons that reach widths of 80 kilometers and depths of perhaps 20 kilometers. The large trenches on Titania (*immediately above*) suggest that the moon had at least one period of severe tectonic activity.



MIRANDA



ARIEL



UMBRIEL



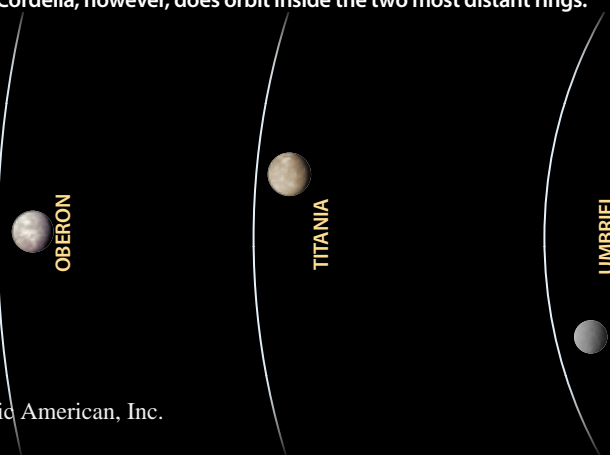
TITANIA



OBERON

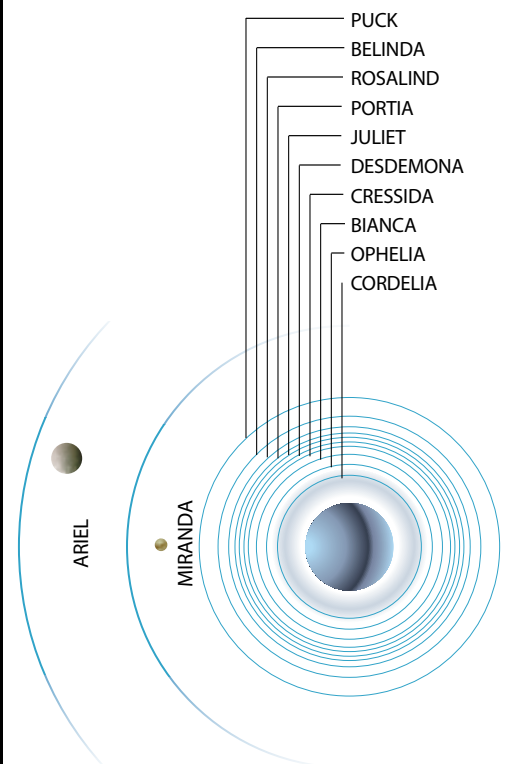
FIFTEEN OF THE MOONS OF URANUS

orbit in near-perfect circles. Although the planet was discovered in 1781, it would be more than two centuries before Voyager found the 10 smaller moons. In the fall of 1997 astronomers found two more very small moons (*not shown*) in relatively eccentric orbits. In general, the rings orbit nearest the planet, followed by the smaller moons, with the large moons farthest away. Innermost Cordelia, however, does orbit inside the two most distant rings.



Strange even by the standards of the far reaches of the solar system, Uranus is an almost featureless, blue-green planet that has the distinction of being knocked on its side. Its axis of rotation points 98 degrees away from its orbital axis. This unique tilt most likely testifies to a massive collision while the planet was still forming. Adding to its peculiarity, Uranus's magnetic field is also tilted, 59 degrees from the rotation axis. Finally, the planet rotates in the opposite direction that Earth does. Although greatly enhanced images from Voyager 2's visit in 1986 reveal bands like those on Saturn and Jupiter, the planet seems to be far more placid than its stormy gas giant comrades. Uranus maintains their custom, however, of accompaniment by rings and numerous satellites.

Ten small moons were discovered by Voyager in 1986. Nine rings were found in 1977 during stellar occultations; two more have been found since.



JPL/CALTECH/NASA (Ariel surface, Miranda, Ariel, Umbriel and Oberon); COURTESY OF A. TRAFUN/ONER (Titania surface); NASA, VOYAGER 2 AND CALVIN J. HAMILTON (Titania); BRYAN CHRISTIE (telegram); JPL (bottom left)