Planetary Tour

Some four and a half billion years ago, and for reasons that scientists have yet to agree upon, a flat, round cloud of gas and dust began to contract in the interstellar space of our Milky Way galaxy, itself already at least five billion years old. As this cloud collapsed toward its center, its relatively small initial rate of spin increased. This spinning, in turn, hurled agglomerations of dust outward, enabling them to resist the gravitational pull of a massive nebula at the center of the cloud.

As this giant central nebula—the precursor of our sun—collapsed in on itself, the temperature at its center soared. Eventually, the heat and pressure were enough to ignite the thermonuclear furnace that would make life possible and that will probably burn for another five billion years.

Over tens of millions of years, the agglomerations of dust surrounding the protosun became the nine planets, 63 moons, and myriad asteroids and comets of our solar system. One of the many unsolved puzzles about the formation of the solar system concerns the arrangement of these planets—specifically, why the first four are small and rocky, and the next four are giant and gaseous. A leading theory—that early, powerful solar flares blew the lighter elements out of the inner solar system—has been challenged by the discovery of gas giant–type planets orbiting very close to sunlike stars in the Milky Way.

In the pages that follow, SCIENTIFIC AMERICAN conducts a guided tour of the solar system. Its purpose, in this issue devoted to the grandeur and complexity of the cosmos, is to reassert the wonders that exist in our own infinitesimal corner of it.

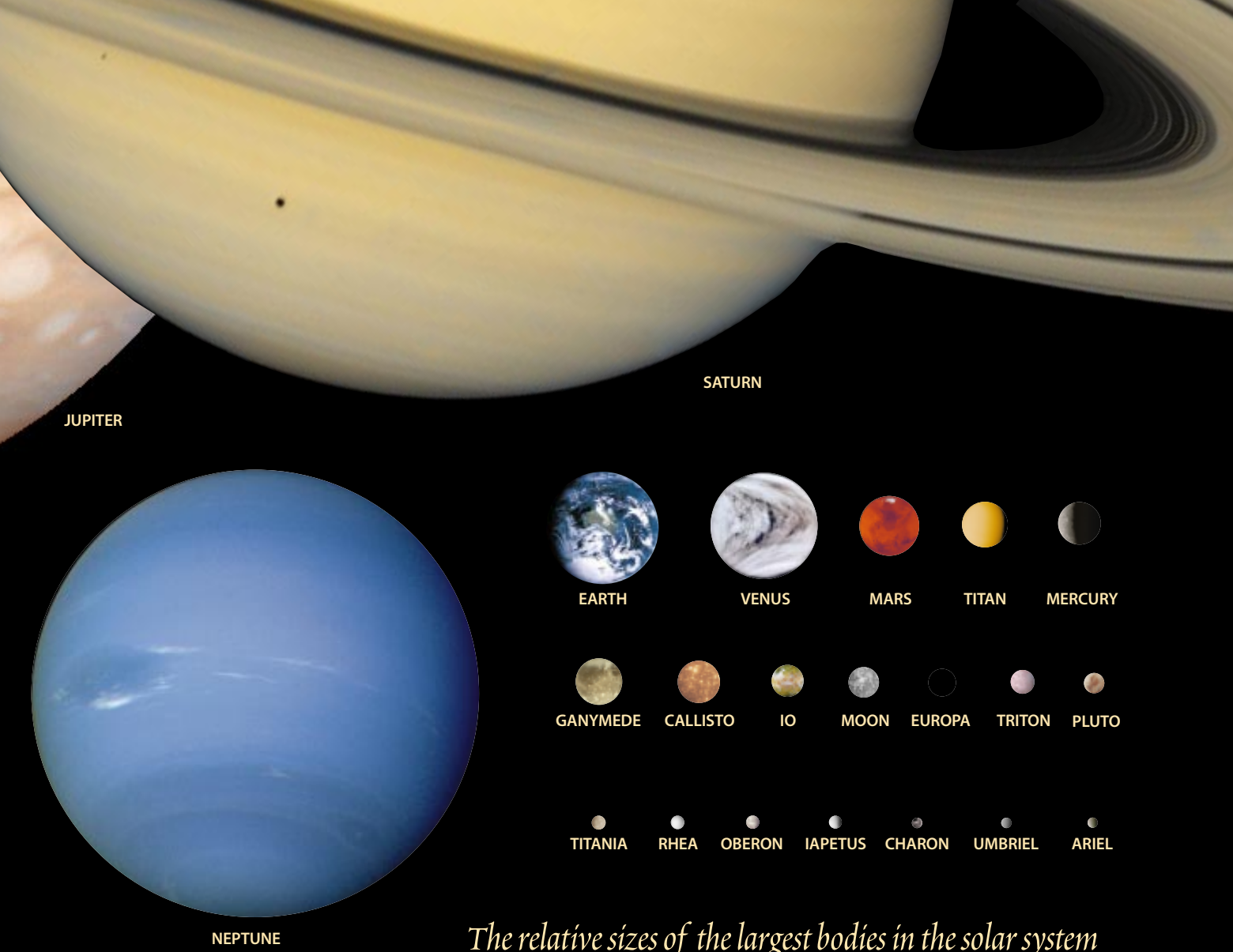
—The Editors

URANUS

The planets at a glance

	MERCURY	VENUS	EARTH	MARS
AVERAGE DISTANCE FROM SUN (kilometers)	57.9 million	108.2 million	149.6 million	227.94 million
EQUATORIAL DIAMETER (kilometers)	4,878	12,100	12,756.34	6,786
MASS (kilograms)	3.3×10^{23}	4.9×10^{24}	6.0×10^{24}	6.4×10^{23}
DENSITY (grams per cubic centimeter)	5.41	5.25	5.52	3.9
LENGTH OF DAY (relative to Earth)	58.6 days	243.0 days	23.93 hours	24.62 hours
LENGTH OF YEAR (relative to Earth)	87.97 days	224.7 days	365.26 days	686.98 days
NUMBER OF KNOWN MOONS	0	0	1	2
ATMOSPHERIC COMPOSITION	Negligible traces of sodium, helium, hydrogen and oxygen	96% carbon dioxide, 3.5% nitrogen	78% nitrogen, 21% oxygen, 0.9% argon	95% carbon dioxide, 3% nitrogen, 1.6% argon

JPL/CALTECH/NASA (*all images*); LAURIE GRACE (*table*)



The relative sizes of the largest bodies in the solar system

JUPITER	SATURN	URANUS	NEPTUNE	PLUTO
778.4 million	1,423.6 million	2,867.0 million	4,488.4 million	5,909.6 million
142,984	120,536	51,108	49,538	2,350
1.9×10^{27}	5.7×10^{26}	8.7×10^{25}	1.0×10^{26}	1.3×10^{22}
1.3	0.7	1.3	1.7	1.99
9.8 hours	10.2 hours	17.9 hours	19.1 hours	6.39 days
11.86 years	29.46 years	84 years	164.8 years	247.7 years
16	At least 19	17	8	1
90% hydrogen, 10% helium, traces of methane	97% hydrogen, 3% helium, traces of methane	83% hydrogen, 15% helium, 2% methane	74% hydrogen, 25% helium, 2% methane	Probably methane, possibly nitrogen and carbon monoxide