

The Giant Planets - Part 1

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Giant Planets



The four giant planets in our solar system all have hydrogen atmospheres, but the warm gas giants, Jupiter and Saturn, have tan, beige, red, and white clouds that are thought to be composed of ammonia ice particles with various colorants called “chromophores.” The blue-tinted ice giants, Uranus and Neptune, are much colder and covered in methane ice clouds. (credit: modification of work by Lunar and Planetary Institute, NASA)



Abundances in the Outer Solar System

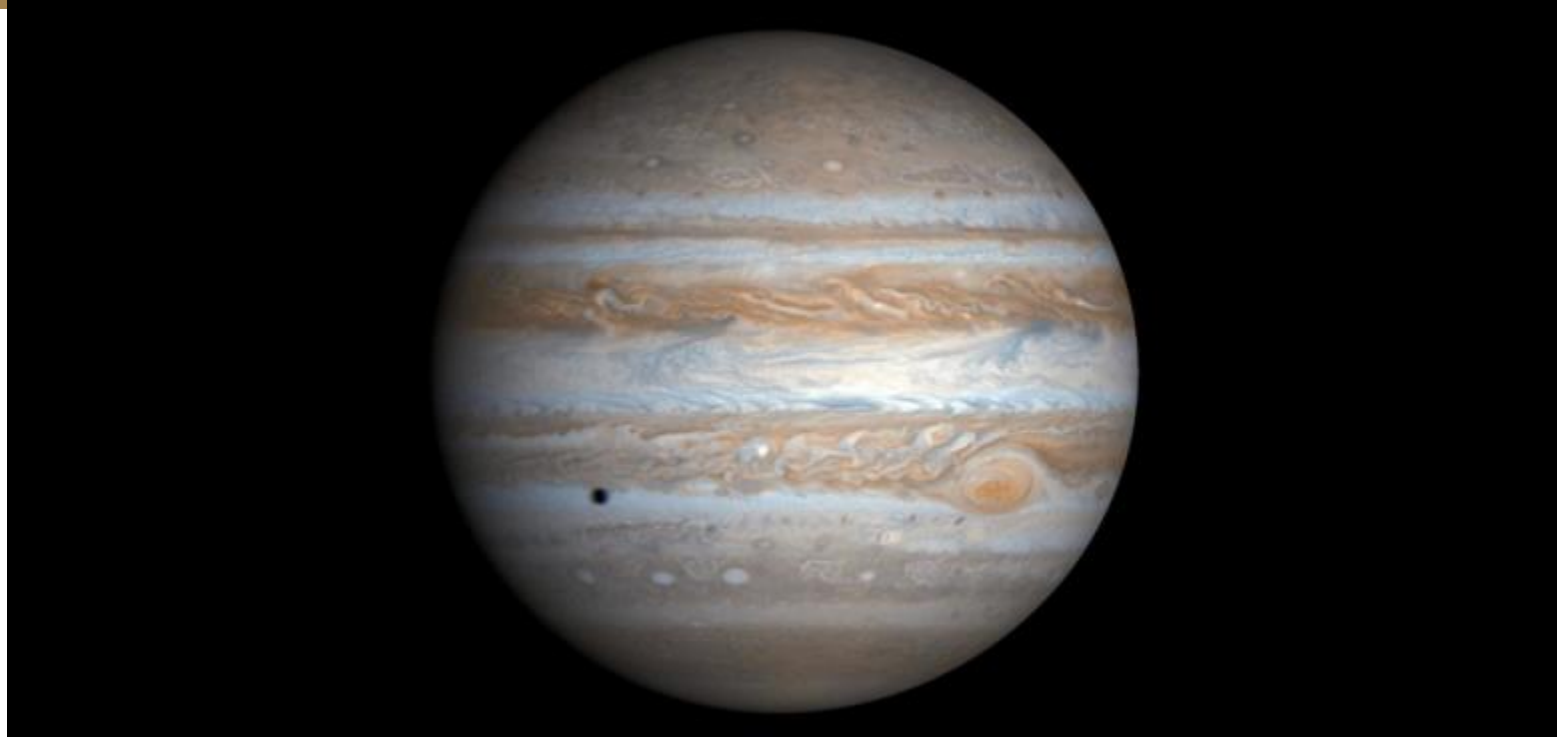
Type of Material	Name	Approximate % (by Mass)
Gas	Hydrogen (H ₂)	75
Gas	Helium (He)	24
Ice	Water (H ₂ O)	0.6
Ice	Methane (CH ₄)	0.4
Ice	Ammonia (NH ₃)	0.1
Rock	Magnesium (Mg), Iron (Fe), Silicon (Si)	0.3

Properties of Jovian Planets

Basic Properties of the Jovian Planets

Planet	Distance (AU)	Period (years)	Diameter (km)	Mass (Earth = 1)	Density (g/cm ³)	Rotation (hours)
Jupiter	5.2	11.9	142,800	318	1.3	9.9
Saturn	9.5	29.5	120,540	95	0.7	10.7
Uranus	19.2	84.1	51,200	14	1.3	17.2
Neptune	30.0	164.8	49,500	17	1.6	16.1

Jupiter



The Cassini spacecraft imaged Jupiter on its way to Saturn in 2012. The giant storm system called the Great Red Spot is visible to the lower right. The dark spot to the lower left is the shadow of Jupiter's moon Europa. (credit: modification of work by NASA/JPL)

Galileo Probe Falling into Jupiter

Juno Image of Jupiter's South Pole



(a)



(b)

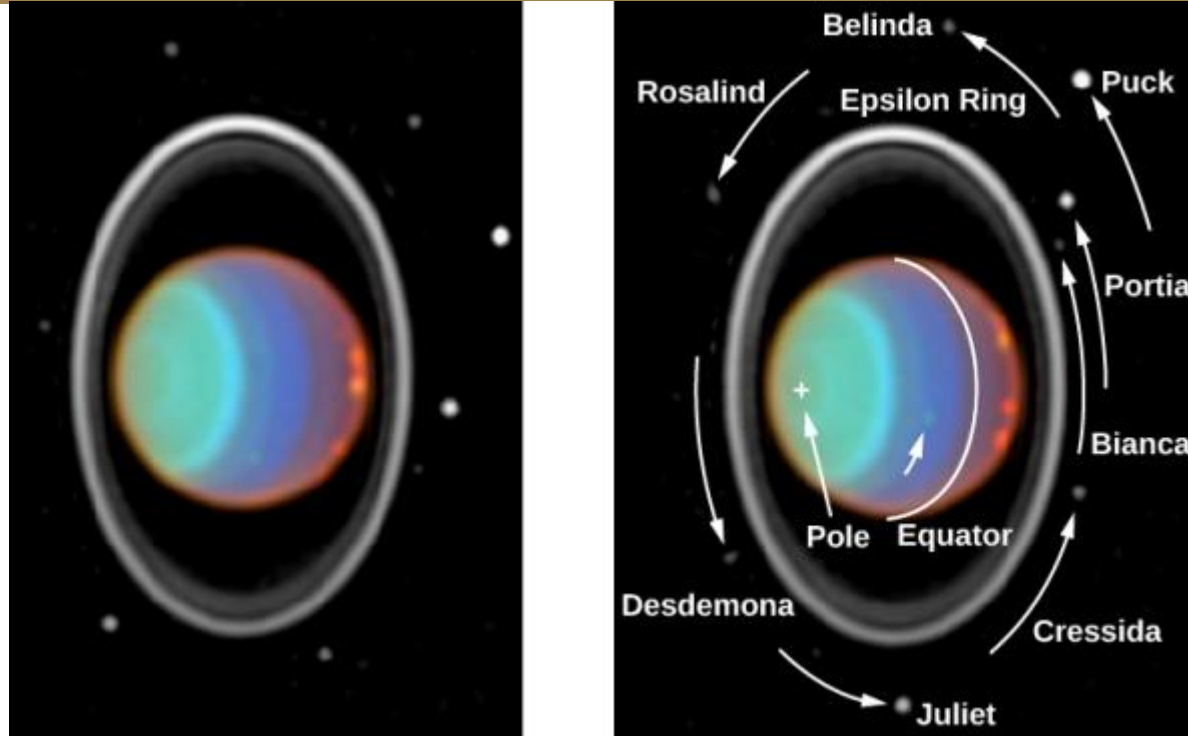
(a) This artist's depiction shows the Galileo probe descending into the clouds via parachute just after the protective heat shield separated. The probe made its measurements of Jupiter's atmosphere on December 7, 1995. (b) This Juno image, taken in 2017 from about 100,000 kilometers above the cloudtops, shows the south polar region of Jupiter with its dramatic complex of storms and clouds. The enhanced-color image was processed for NASA/JPL by citizen scientist John Landino. (credit a: modification of work by NASA/Ames Research Center; credit b: modification of work by NASA/JPL-Caltech/SwRI/MSSS/John Landino)

Earth as seen from Saturn

This popular Cassini image shows Earth as a tiny dot (marked with an arrow) seen below Saturn's rings. It was taken in July 2013, when Saturn was 1.4 billion kilometers from Earth. (credit: modification of work by NASA/JPL-Caltech/Space Science Institute)

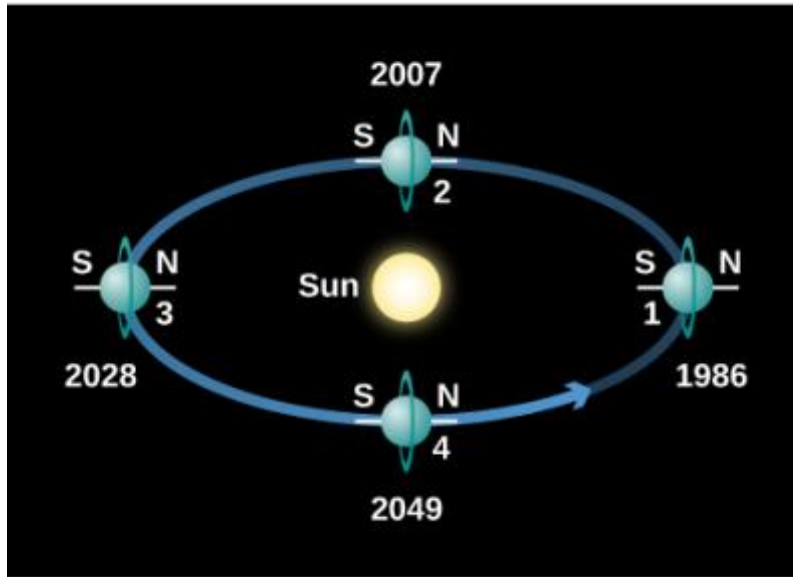


Infrared Image of Uranus

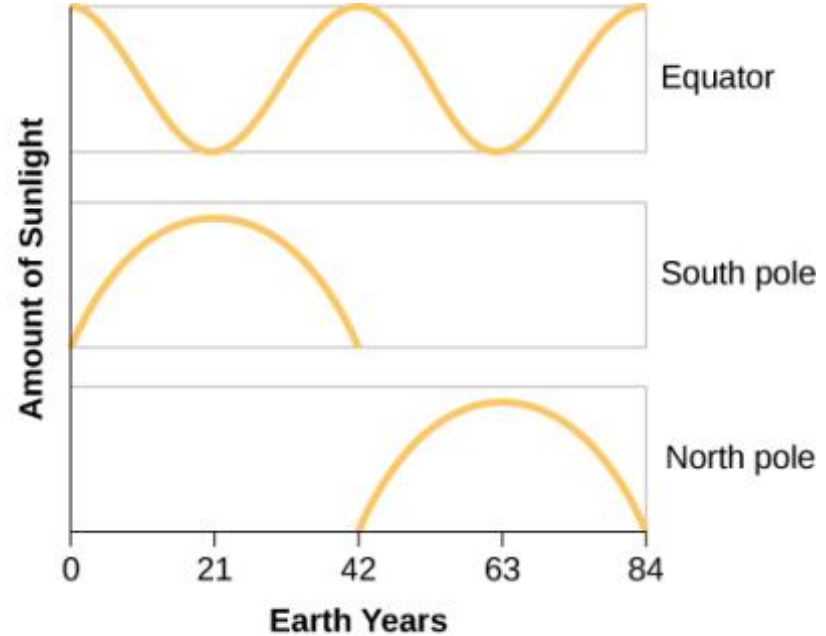


The infrared camera on the Hubble Space Telescope took these false-color images of the planet Uranus, its ring system, and moons in 1997. The south pole of the planet (marked with a “+” on the right image) faces the Sun; its green color shows a strong local haze. The two images were taken 90 minutes apart, and during that time the five reddish clouds can be seen to rotate around the parallel to the equator. The rings (which are very faint in the visible light, but prominent in infrared) and eight moons can be seen around the equator. This was the “bull’s eye” arrangement that Voyager saw as it approached Uranus in 1986. (credit: modification of work by Erich Karkoschka (University of Arizona), and NASA/ESA)

Strange Seasons on Uranus



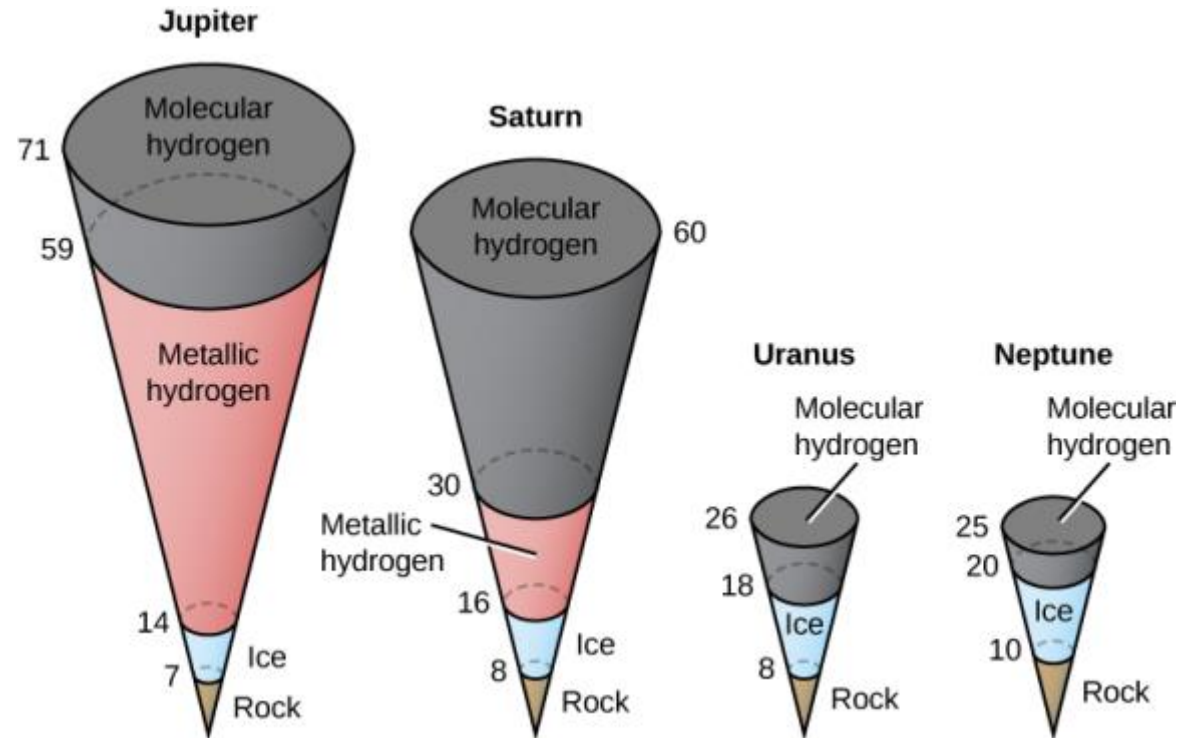
(a)



(b)

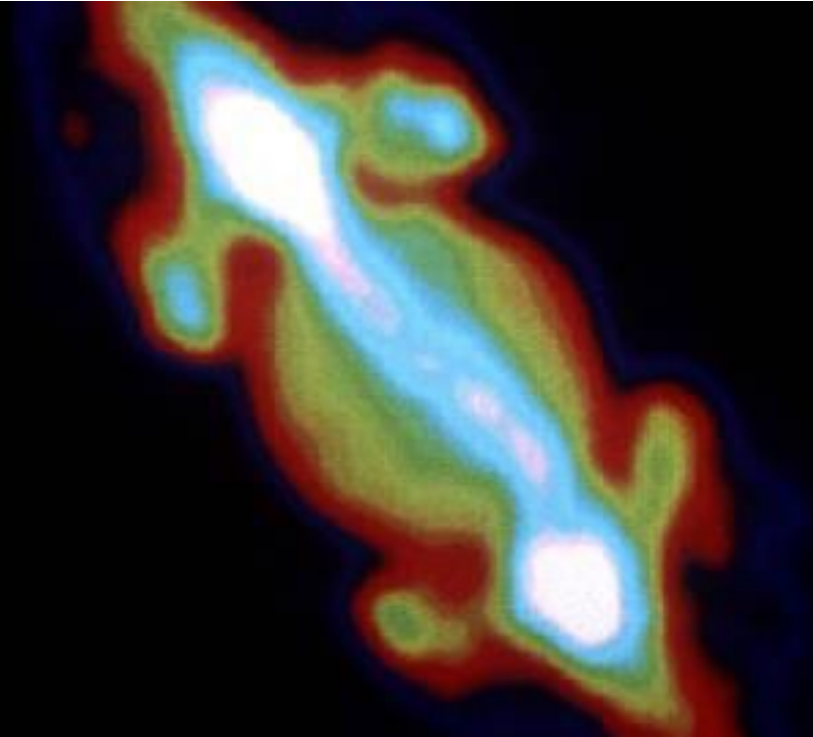
This diagram (a) shows the orbit of Uranus as seen from above. At the time Voyager 2 arrived (position 1), the South Pole was facing the Sun. As we move counterclockwise in the diagram, we see the planet 21 years later at each step. This graph (b) compares the amount of sunlight seen at the poles and the equator of Uranus over the course of its 84-year revolution around the Sun.

Internal Structures of the Jovian Planets



Jupiter and Saturn are composed primarily of hydrogen and helium (but hydrogen dominates), but Uranus and Neptune consist in large part of compounds of carbon, nitrogen, and oxygen. (The diagrams are drawn to scale; numbers show radii in thousands of kilometers.)

Jupiter in Radio Waves



This false-color image of Jupiter was made with the Very Large Array (of radio telescopes) in New Mexico. We see part of the magnetosphere, brightest in the middle because the largest number of charged particles are in the equatorial zone of Jupiter. The planet itself is slightly smaller than the green oval in the center. Different colors are used to indicate different intensities of synchrotron radiation. (credit: modification of work by I. de Pater (UC Berkeley) NRAO, AUI, NSF)

James Van Allen (1914–2006)

In this 1950s photograph, Van Allen holds a “rockoon.” (credit: modification of work by Frederick W. Kent Collection, University of Iowa Archives)

