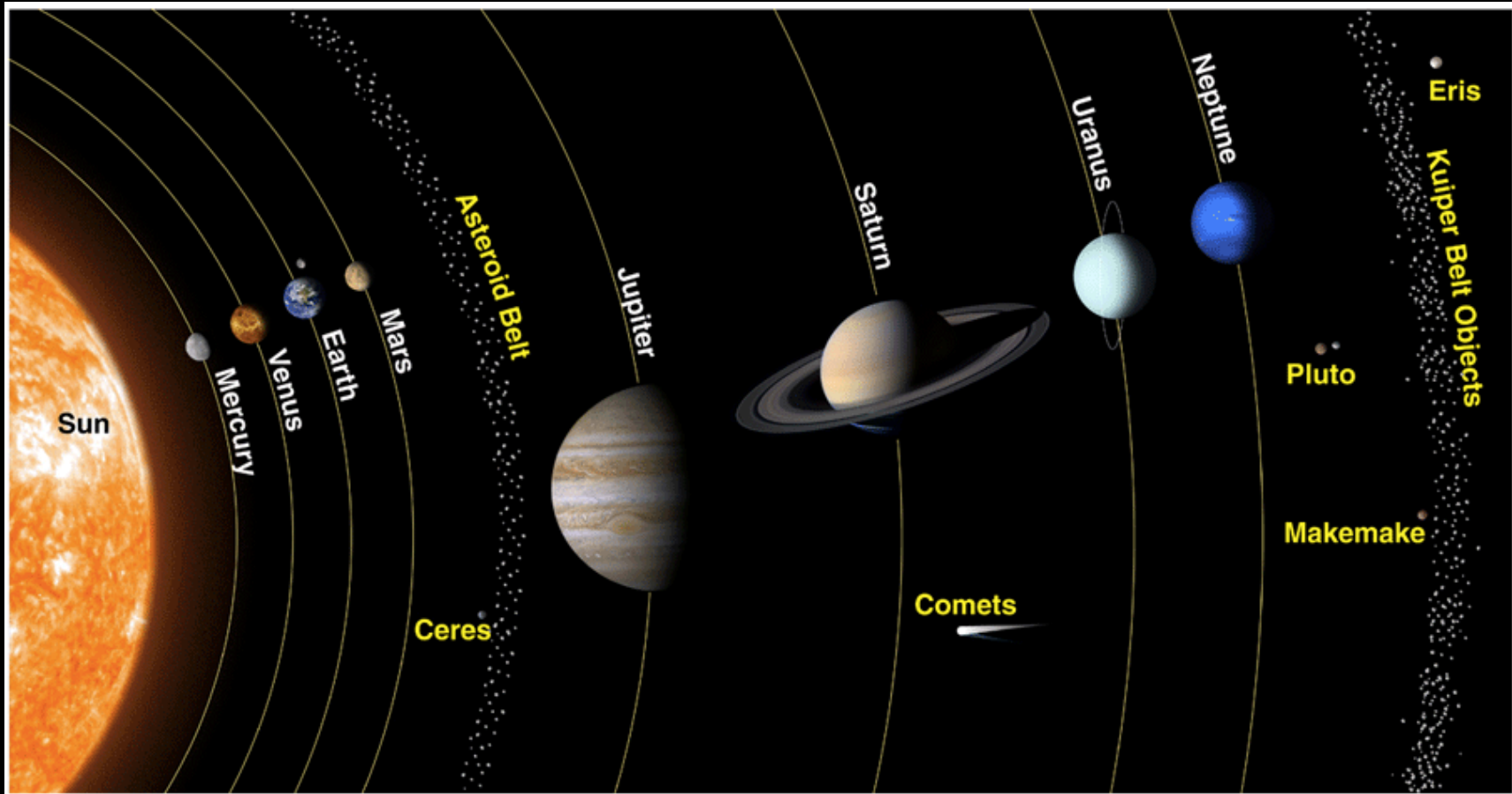


A quick tour of
The Solar System

Physics 108
Introduction to Cosmology
Spring 2012

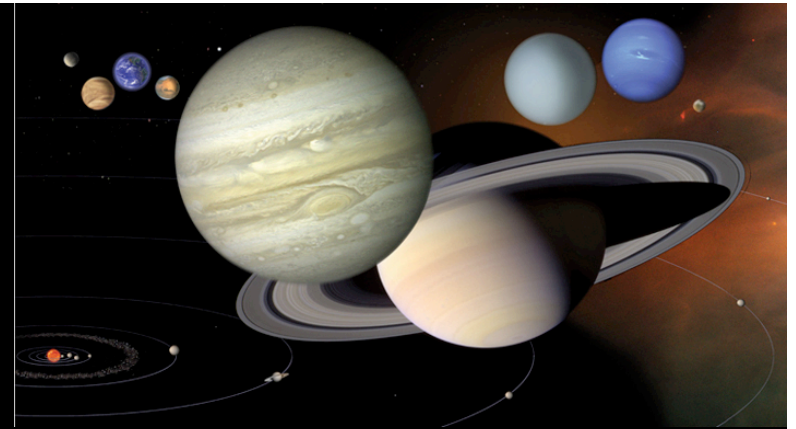
The Solar System



Distances

THE THOUSAND-YARD MODEL *or, The Earth as a Peppercorn*

<http://www.noao.edu/education/peppercorn/pcmain.html>



Object	Size (example)	Added distance	Total distance
Sun	8 " (Bowling Ball)	start	0 paces
Mercury	0.03" (pinhead)	+10 paces	10 paces
Venus	0.08" (peppercorn)	+9 paces	19 paces
Earth	0.08" (peppercorn)	+7 paces	26 paces
Mars	0.03" (pinhead)	+14 paces	40 paces
Jupiter	0.90" (chestnut)	+95 paces	135 paces
Saturn	0.70" (acorn)	+112 paces	247 paces
Uranus	0.30" (coffee bean)	+249 paces	496 paces
Neptune	0.30" (coffee bean)	+281 paces	777 paces
Pluto	(pinhead)	+242 paces	1019 paces

Mercury



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Table 10.2 Planetary Data

Mercury

Orbital distance	0.39 AU
Orbital period	0.24 years
Mass	$0.055 M_{\text{Earth}} = 3.30 \times 10^{23} \text{ kg}$
Diameter	$0.38 D_{\text{Earth}} = 4878 \text{ km}$
Density (relative to water)	5.43
Escape velocity	4.3 km/s
Surface gravity	0.38 g
Global temperature	400 K
Main atmospheric gases	Na, O, He
Rotation period	59 days
Axial tilt	2°
Known satellites	0
Distinguishing features	Greatest range of surface temperature, great cliffs on surface

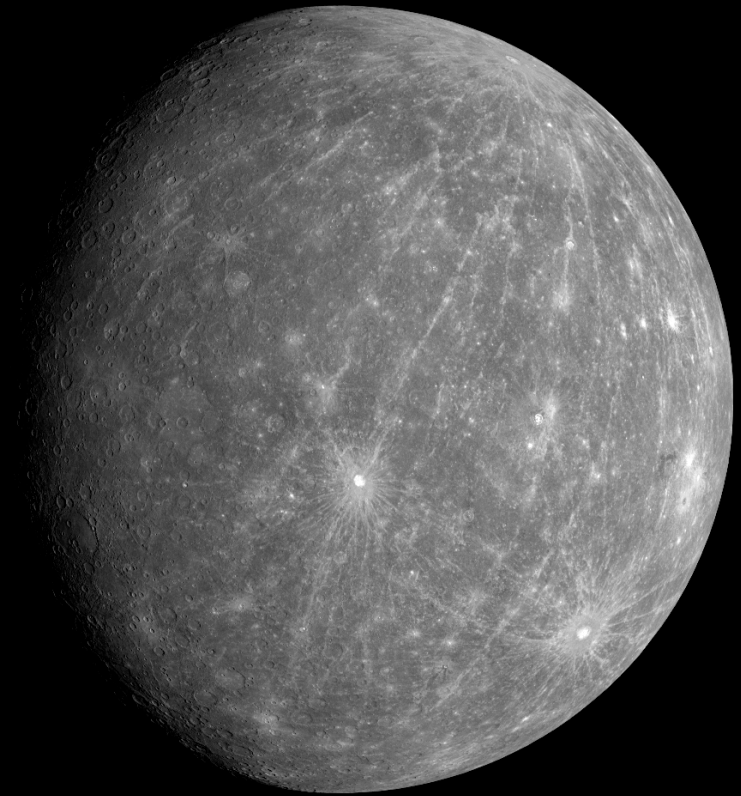


Image Credit: NASA

Day temp: 750° F / 400° C

Night temp: -328° F / -200° C

Venus



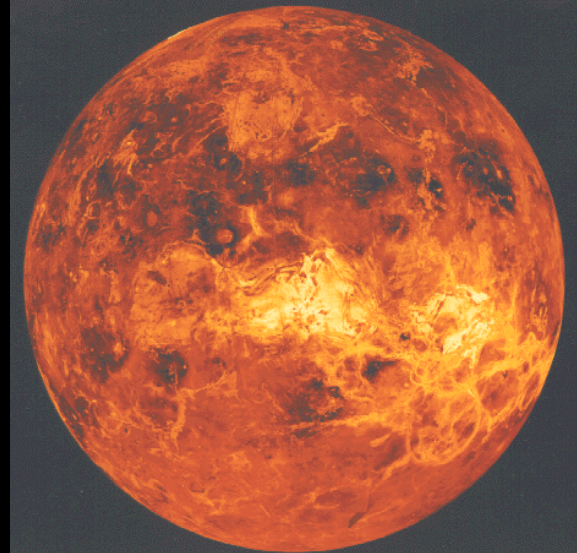
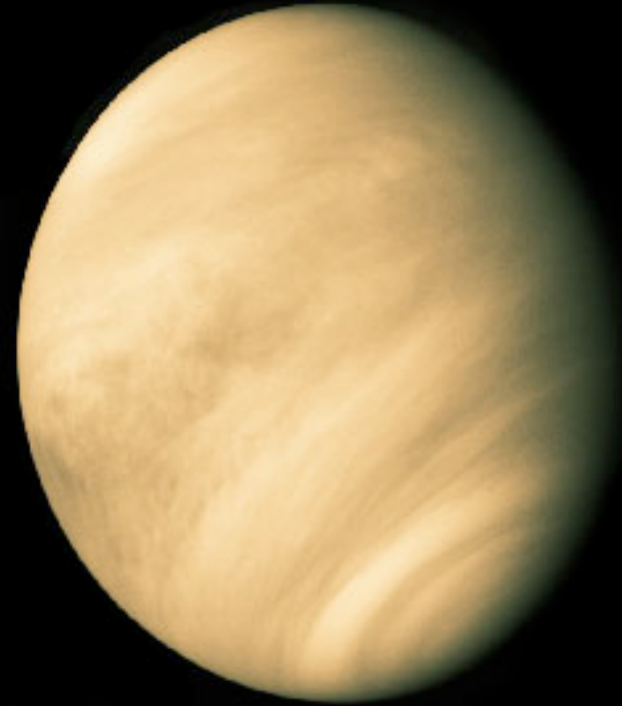
Transit of Venus on 5 June 2012
(last in 2004, next transit in 2117)
see <http://www.transitofvenus.org/>

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Table 10.3 Planetary Data

Venus

Orbital period	0.62 years
Mass	$0.82 M_{\text{Earth}} = 4.87 \times 10^{24} \text{ kg}$
Diameter	$0.95 D_{\text{Earth}} = 12,104 \text{ km}$
Density (relative to water)	5.24
Escape velocity	10 km/s
Surface gravity	0.91 g
Global temperature	730 K
Main atmospheric gases	CO ₂ , N ₂
Rotation period	243 days
Axial tilt	177°
Known satellites	0
Distinguishing features	Thick, hot atmosphere, retrograde rotation



Earth

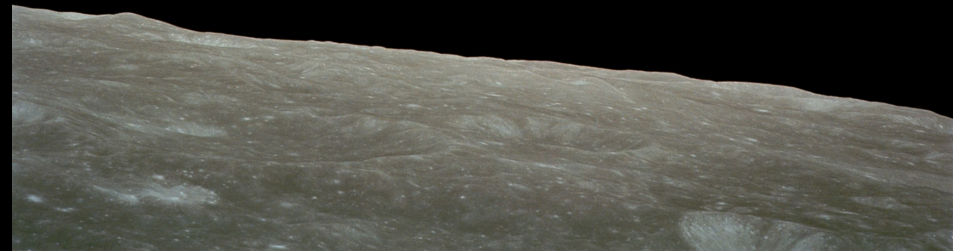


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Table 8.1 Planetary Data

Earth

Orbital distance	1.0 AU
Orbital period	1.0 years
Mass	$1.0 M_{\text{Earth}} = 5.974 \times 10^{24} \text{ Kg}$
Diameter	$1.0 D_{\text{Earth}} = 12,756 \text{ km}$
Density (relative to water)	5.52
Escape velocity	11 km/s
Surface gravity	1.0 g
Global temperature	280 K
Main atmospheric gases	O ₂ , N ₂
Rotation period	1 day
Axial tilt	23°
Known satellites	1
Distinguishing features	Life, liquid water



Mars



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Table 11.1 Planetary Data

Mars

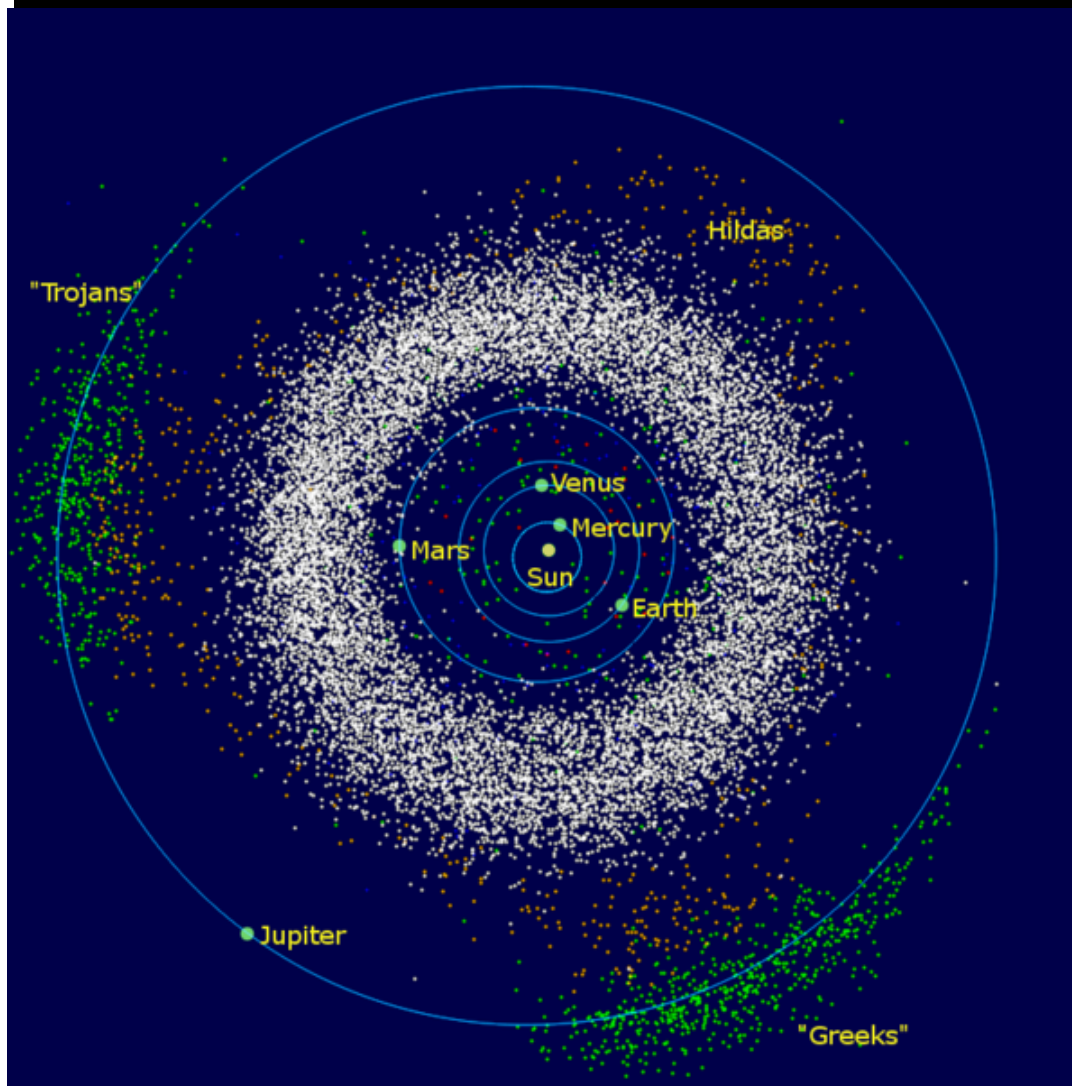
Orbital period	1.88 years
Mass	$0.11 M_{\text{Earth}} = 6.42 \times 10^{23} \text{ kg}$
Diameter	$0.53 D_{\text{Earth}} = 6794 \text{ km}$
Density (relative to water)	3.94
Escape velocity	5.0 km/s
Surface gravity	0.38 g
Global temperature	210 K
Main atmospheric gases	CO ₂ , N ₂ , Ar
Rotation period	24.6 hours
Axial tilt	25°
Known satellites	2
Distinguishing features	Most "Earthlike" environment, evidence of



Asteroids



Image of Eros from NASA



Ceres • January 24, 2004
HSTACS/HRC

Vesta • May 14, 2007
HST/WFPC2

NASA, ESA, J. Parker (Southwest Research Institute), and L. McFadden (University of Maryland)
STScI-PR0007-21a

Jupiter

4

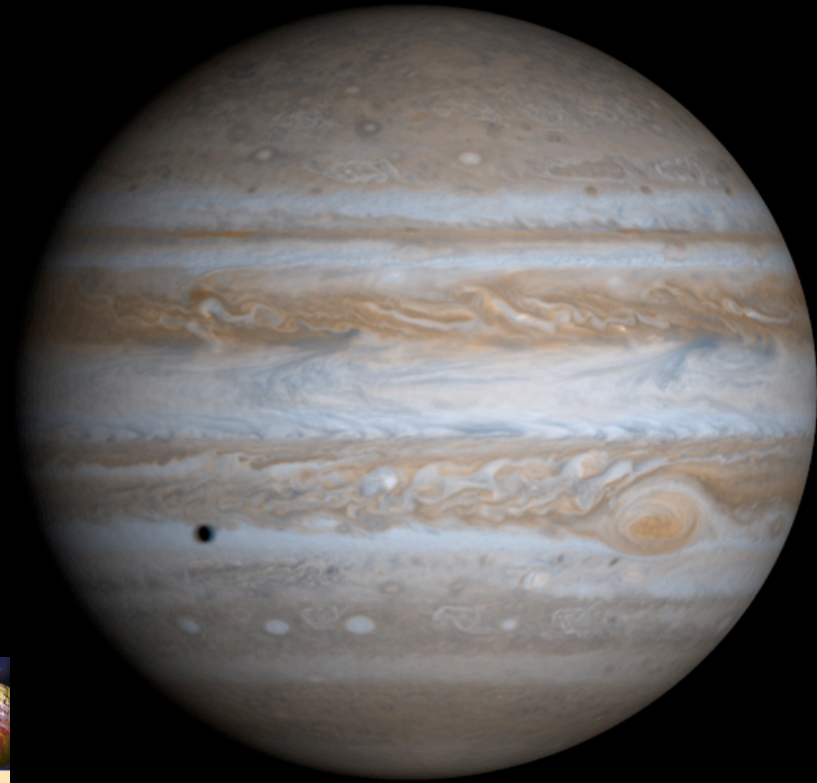


Table 12.1 Planetary Data

Jupiter

Orbital distance	5.2 AU
Orbital period	11.9 years
Mass	$318 M_{\text{Earth}} = 1.90 \times 10^{27} \text{ kg}$
Diameter	$11.2 D_{\text{Earth}} = 142,980 \text{ km}$
Density (relative to water)	1.33
Escape velocity	60 km/s
Surface gravity	2.54 g
Global temperature	125 K
Main atmospheric gases	H, He
Rotation period	9.9 hours
Axial tilt	3°
Known satellites	63
Distinguishing features	Most massive planet, conspicuous cloud features

Saturn

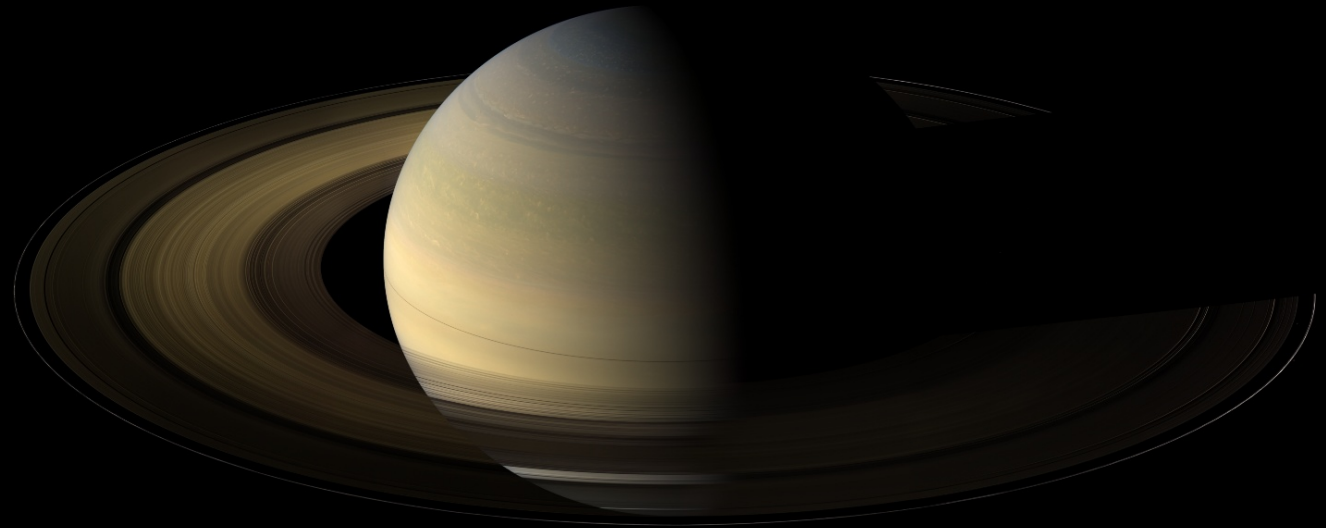
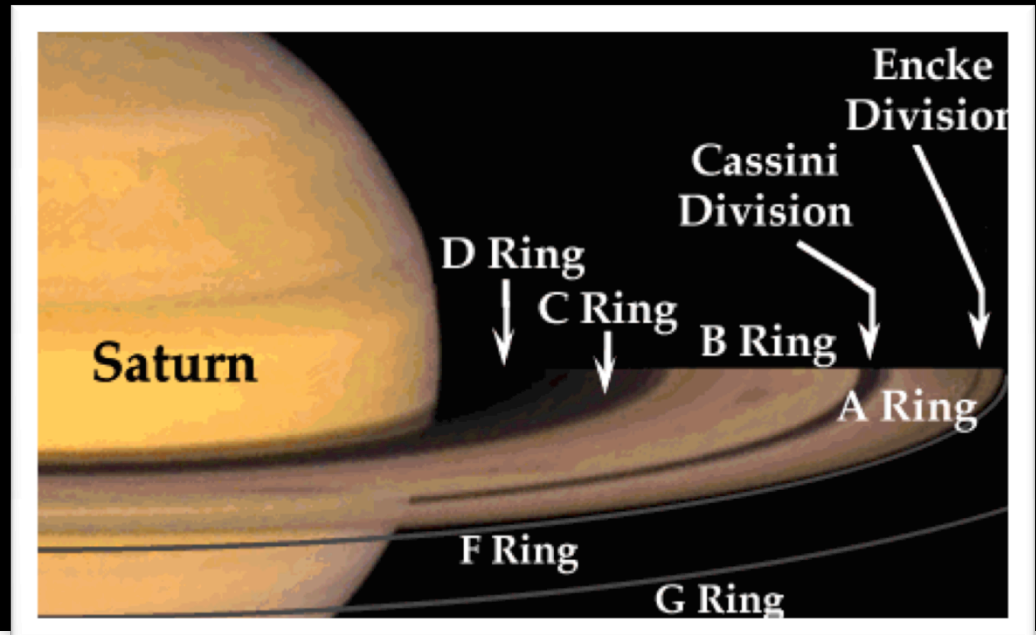


Table 12.2
Planetary Data

Saturn

Orbital distance	9.5 AU
Orbital period	29.5 years
Mass	$95 M_{\text{Earth}} = 5.69 \times 10^{26} \text{ kg}$
Diameter	$9.5 D_{\text{Earth}} = 120,540 \text{ km}$
Density (relative to water)	0.69
Escape velocity	36 km/s
Surface gravity	1.08 g
Global temperature	95 K
Main atmospheric gases	H, He
Rotation period	10.7 hours
Axial tilt	27°
Known satellites	60
Distinguishing features	Spectacular ring system, density less than that of water



Uranus

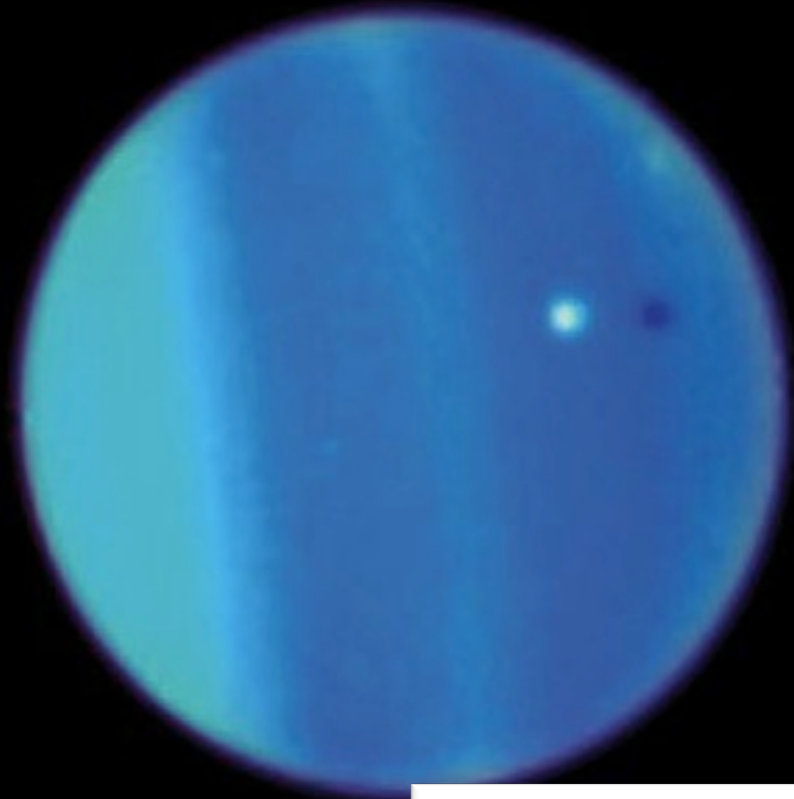
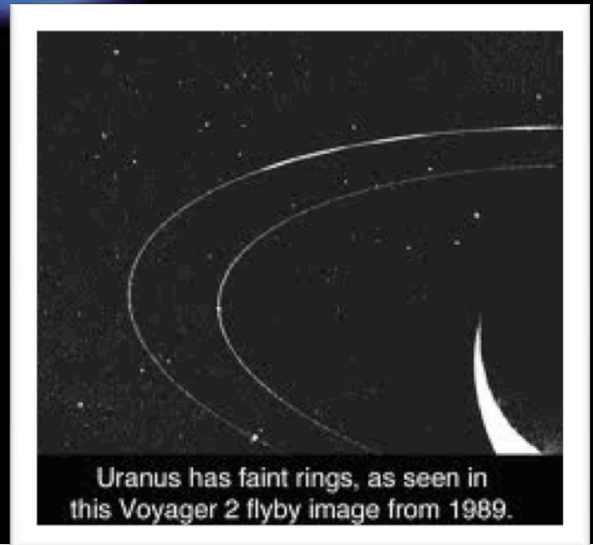


Table 13.1 Planetary Data

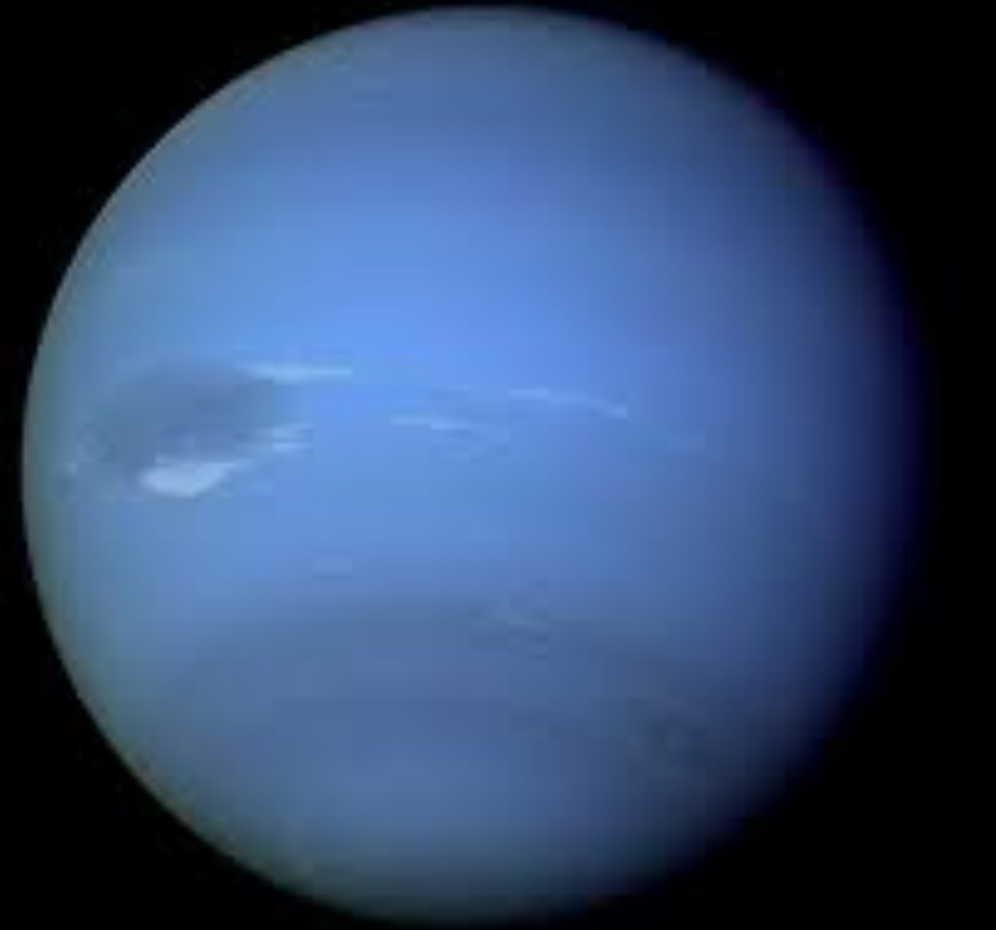
Uranus

Orbital distance	19.2 AU
Orbital period	84.0 years
Mass	$14.5 M_{\text{Earth}} = 8.69 \times 10^{25} \text{ kg}$
Diameter	$4.0 D_{\text{Earth}} = 51,120 \text{ km}$
Density (relative to water)	1.3
Escape velocity	21 km/s
Surface gravity	0.91 g
Global temperature	60 K
Main atmospheric gases	H, He
Rotation period	17.2 hours
Axial tilt	98°
Known satellites	27
Distinguishing features	Rotation axis nearly in orbital plane, ring system consisting of many narrow



Uranus has faint rings, as seen in this Voyager 2 flyby image from 1989.

Neptune



Neptune

Table 13.2 Planetary Data

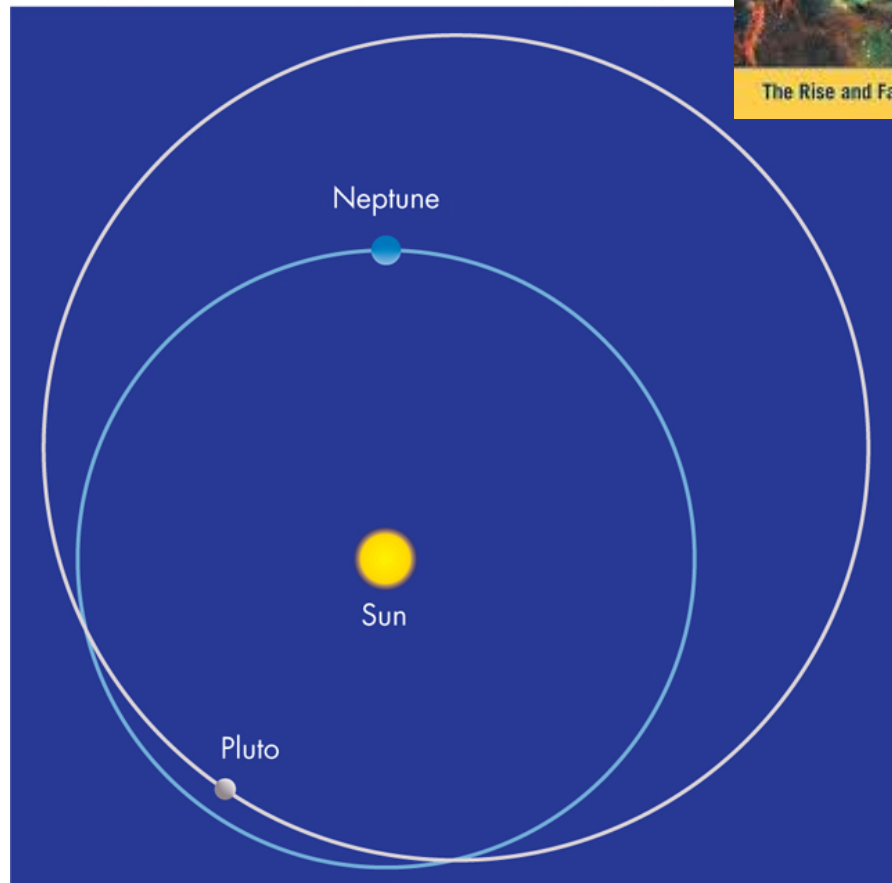
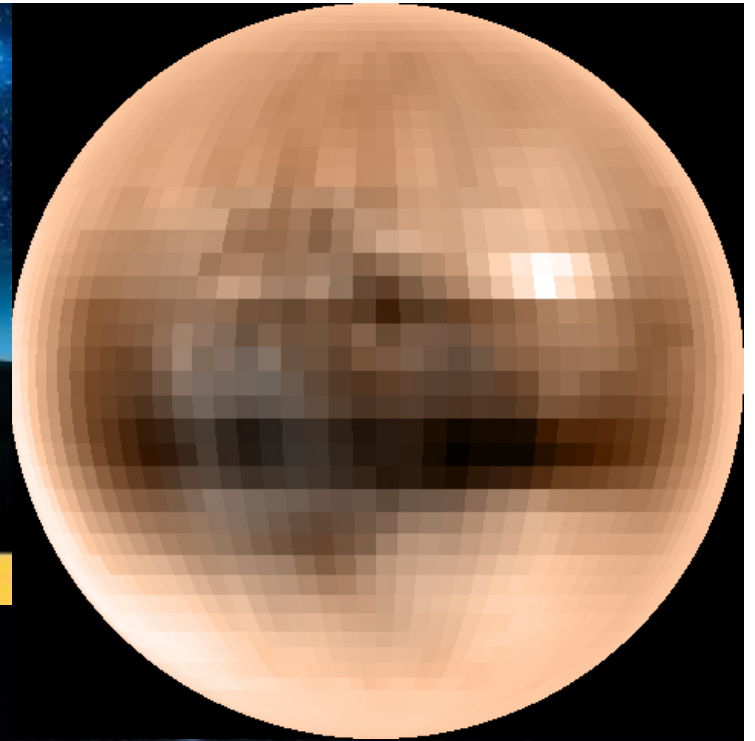
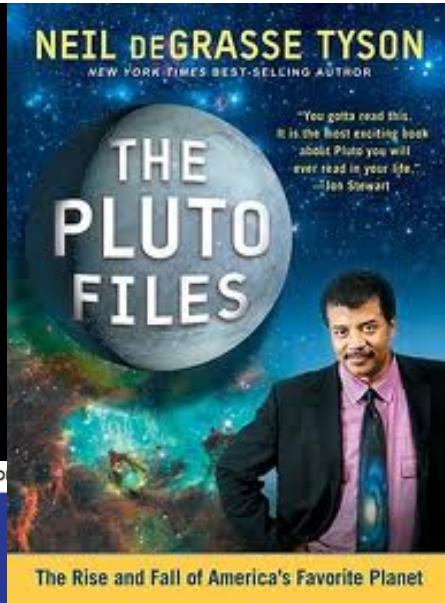
Neptune

Orbital distance	30.1 AU
Orbital period	164.8 years
Mass	$17.1 M_{\text{Earth}} = 1.02 \times 10^{26} \text{ kg}$
Diameter	$3.9 D_{\text{Earth}} = 49,530 \text{ km}$
Density (relative to water)	1.6
Escape velocity	23 km/s
Surface gravity	1.19 g
Global temperature	60 K
Main atmospheric gases	H, He
Rotation period	16.1 hours
Axial tilt	30°
Known satellites	13
Distinguishing features	Conspicuous cloud features, massive core of rock and ice

Pluto



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A Top view of Neptune's and Pluto's orbits

Prince

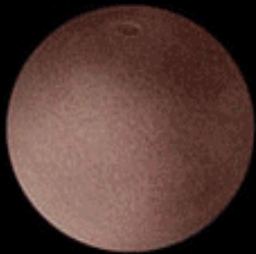


Prince

Age:	53
Density:	1000 kg/m ³
Atmosphere:	Purple Rain
Discovered:	1976

Dwarf Planets

Makemake



Dysnomia



Eris



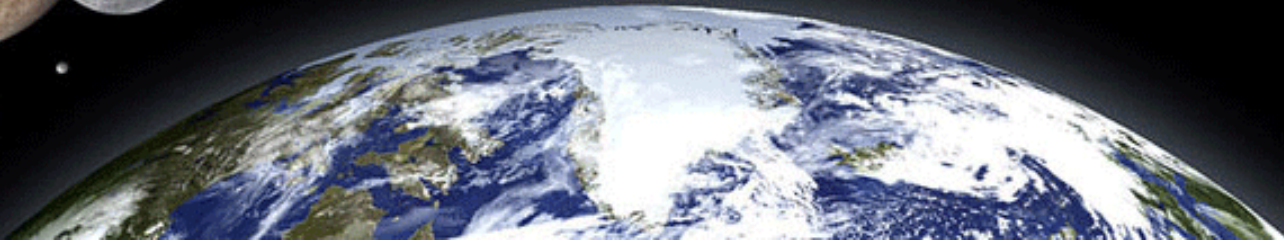
Luna

Charon

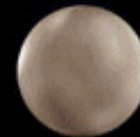


Pluto

Earth



Ceres



Gravity Wells

By Randall Munroe

xkcd

<http://xkcd.com/681/>

