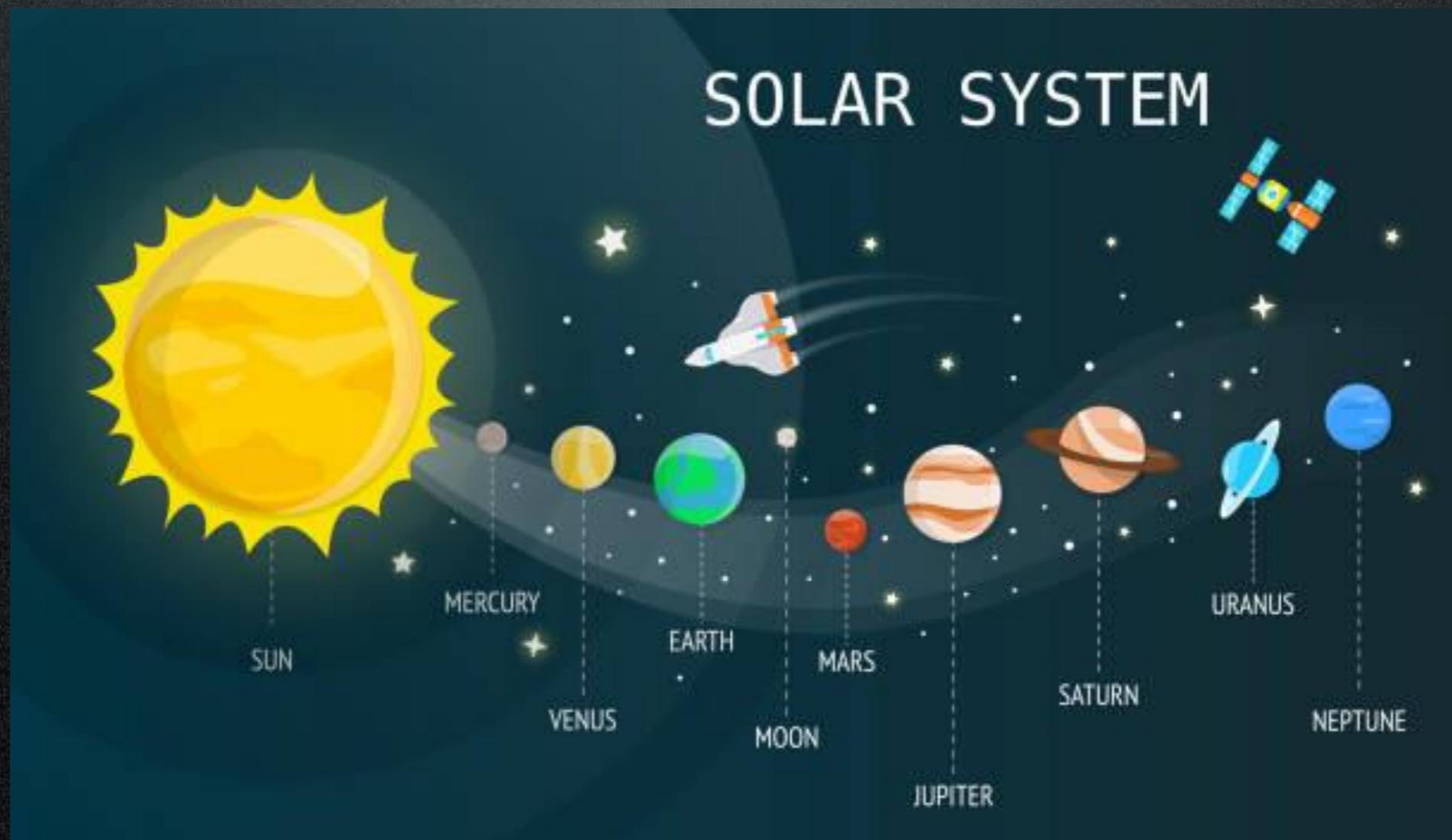


The Remaining Planets & Other Solar System Objects



Want to learn how to help a friend having a hard time? :

<https://www.colorado.edu/health/trainings#mental health first aid-267>

Need someone to talk to?

<https://www.colorado.edu/counseling/>

Short, sweet self-care tips:

<https://www.colorado.edu/health/mental-health>

Observing through a Telescope Assignment

- Remote only

What makes Venus yellowish?

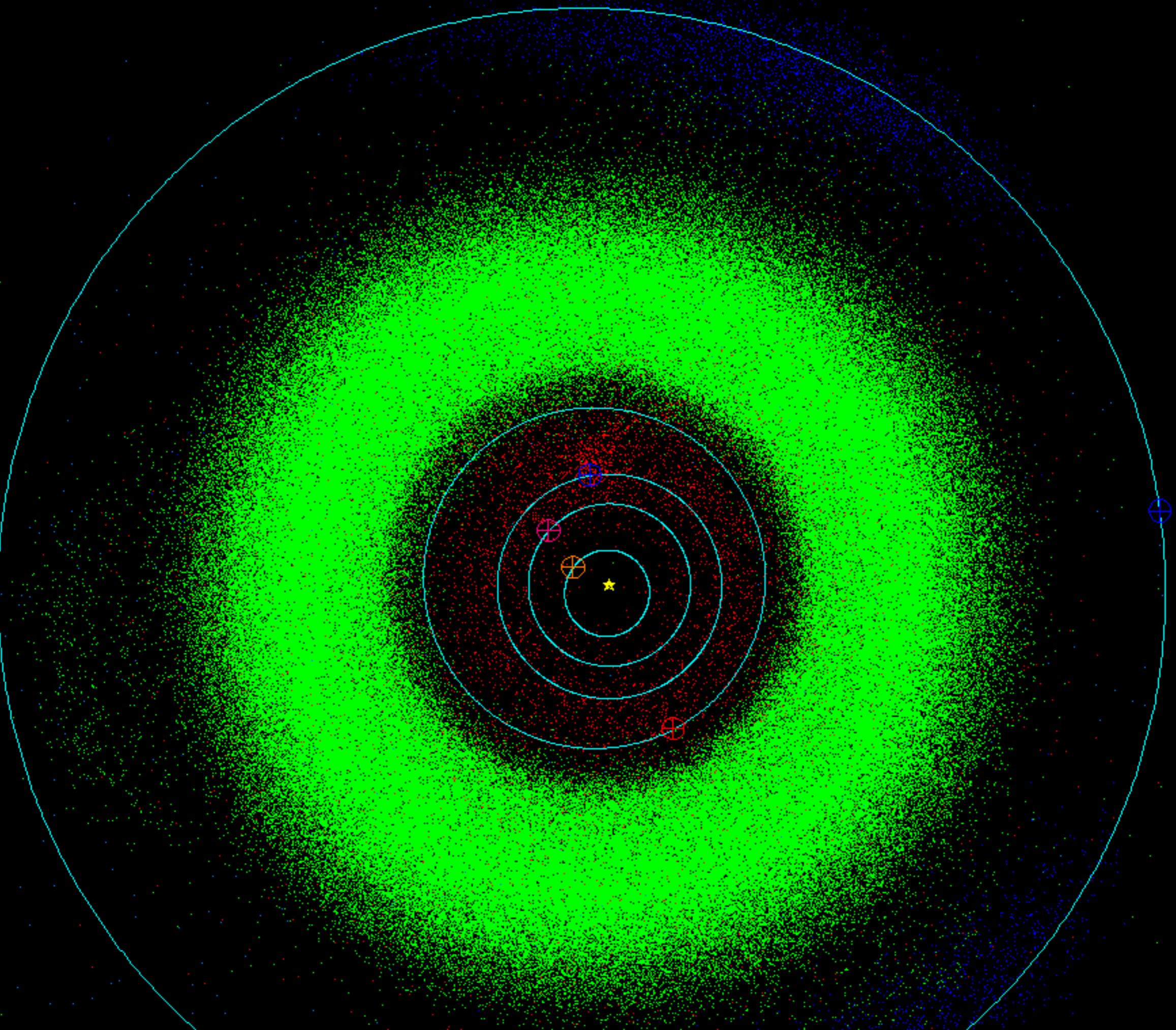
- Surface is brown/red
- Atmosphere is sulfuric acid, sulfur dioxide, and carbon dioxide
 - All of these are colorless although sulfur is yellow

Is daylength the same as rotational period?

Planet	Rotational Period
Mercury	1,408 hours
Venus	5,832 hours
Earth	24 hours
Mars	25 hours
Jupiter	10 hours
Saturn	11 hours
Uranus	17 hours
Neptune	16 hours

Seasons Simulator and Obliquity Simulator

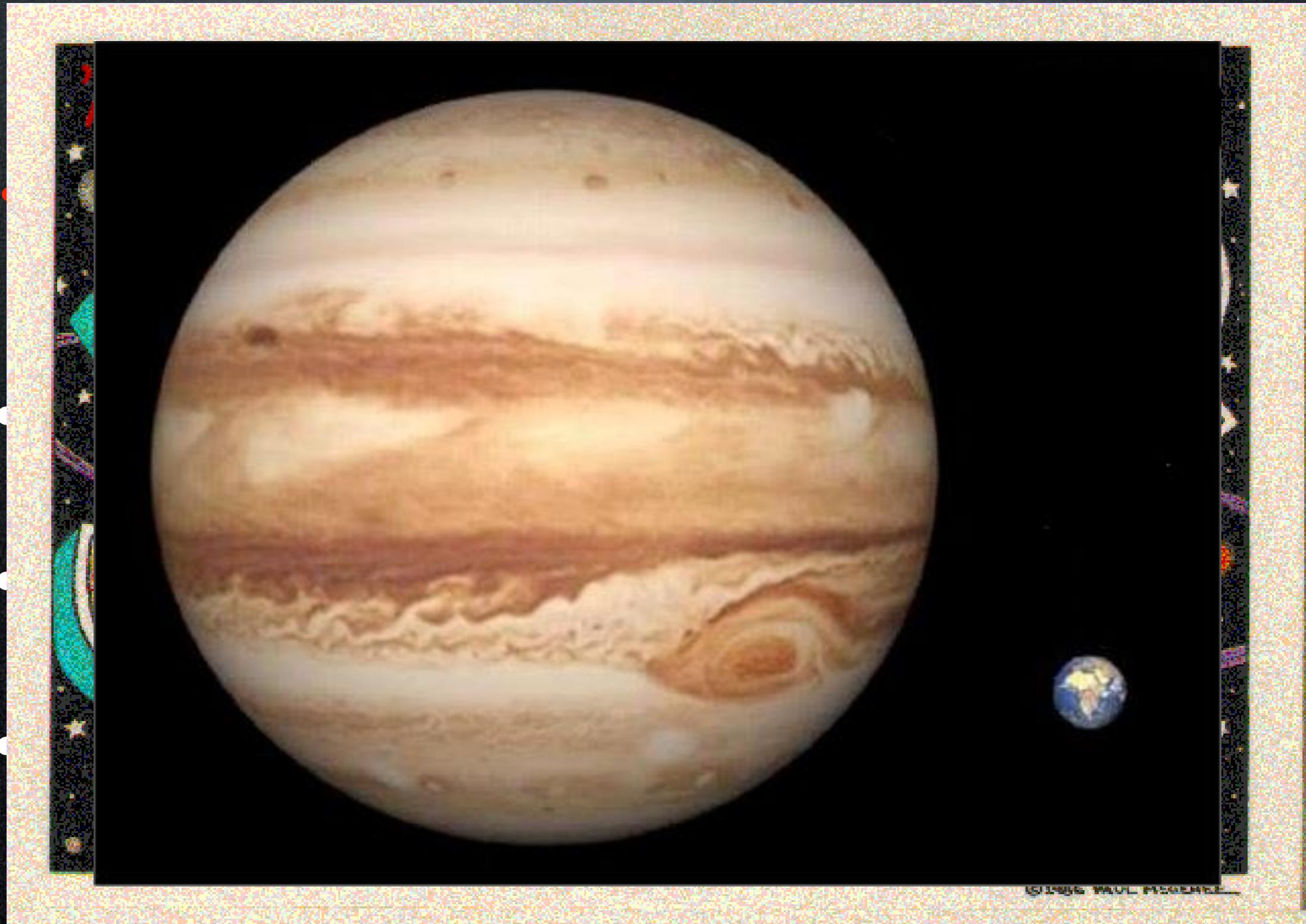
<https://apod.nasa.gov/apod/ap190520.html>



The Jovian Planets

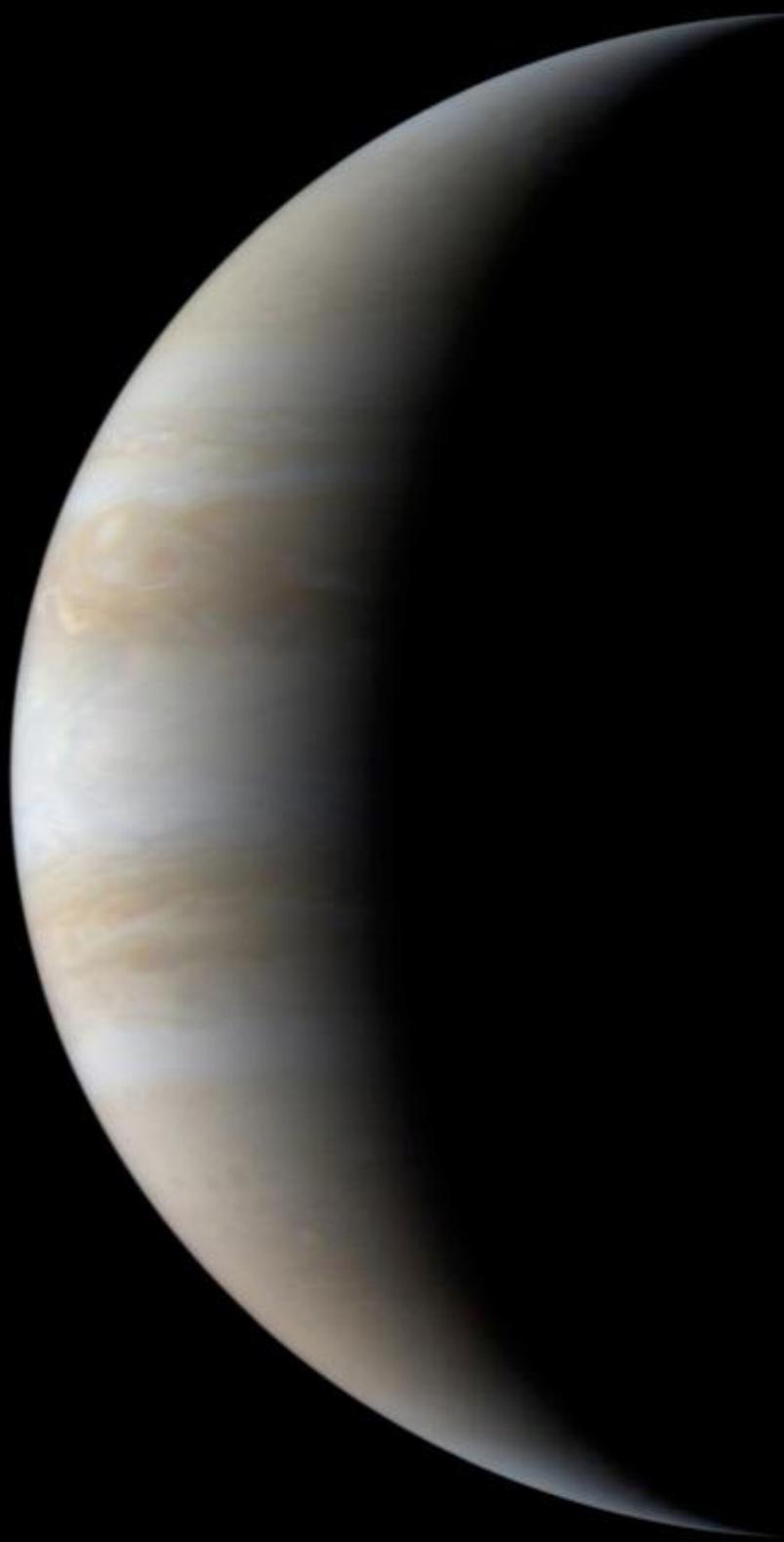
- The gas giants are Jupiter, Saturn, Uranus and Neptune.
- Much larger and more massive.
- Do not have a solid surface. We see the upper cloud layers.
- About 75% Hydrogen and 25% Helium.
- Many moons. And all have rings.

Jupiter



©1996 PAUL FINEART

(



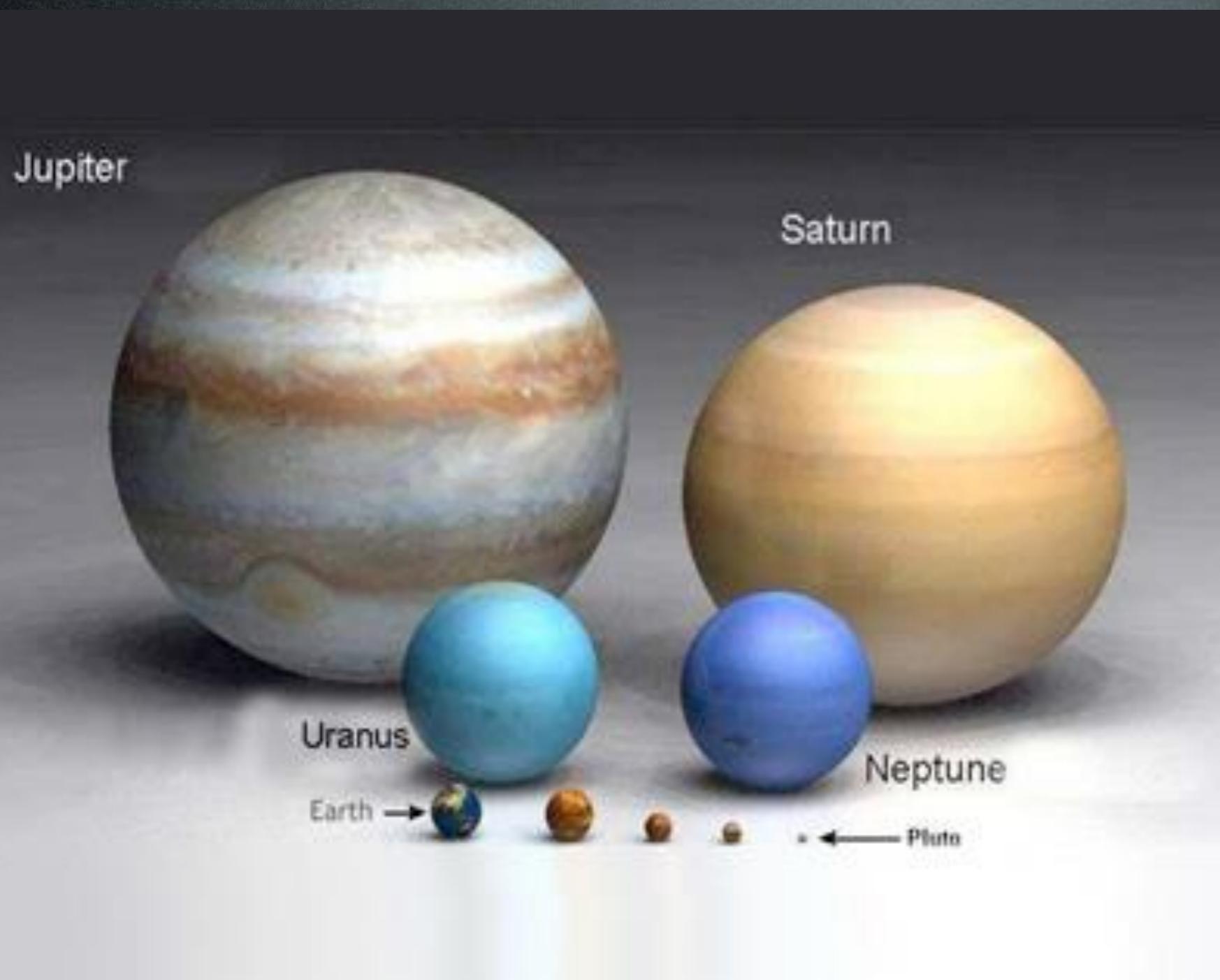
12 years - 1 revolution

~ -250°F

over 60 moons

- Jupiter's Bands:
- <https://www.youtube.com/watch?v=EEDIOrXJ24E>

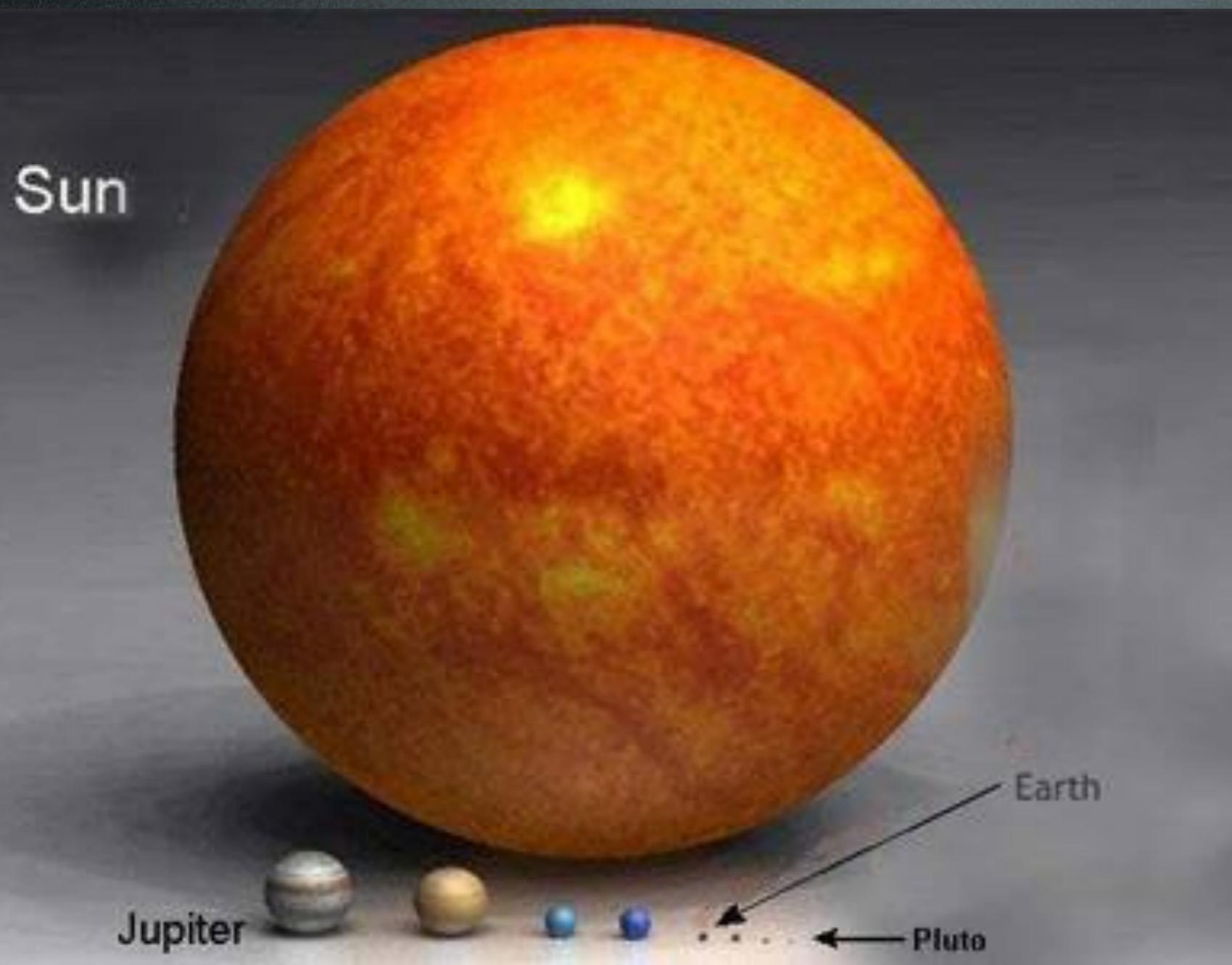
The Scale of the Solar System



How many
Earths would fit
across Jupiter?

- A. 5
- B. 11
- C. 20
- D. 30

The Scale of the Solar System



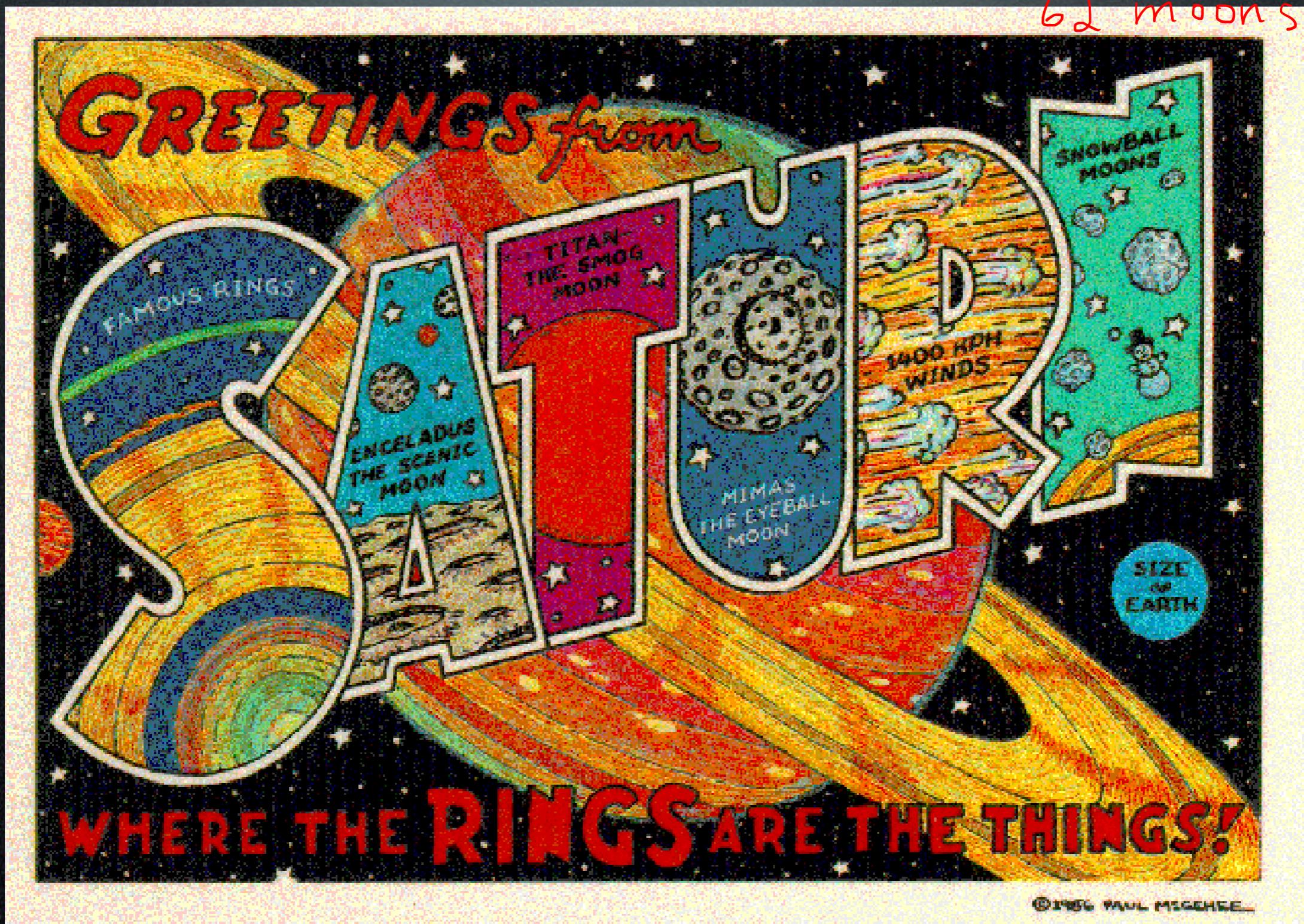
How many Jupiters would fit across the Sun end-to end?

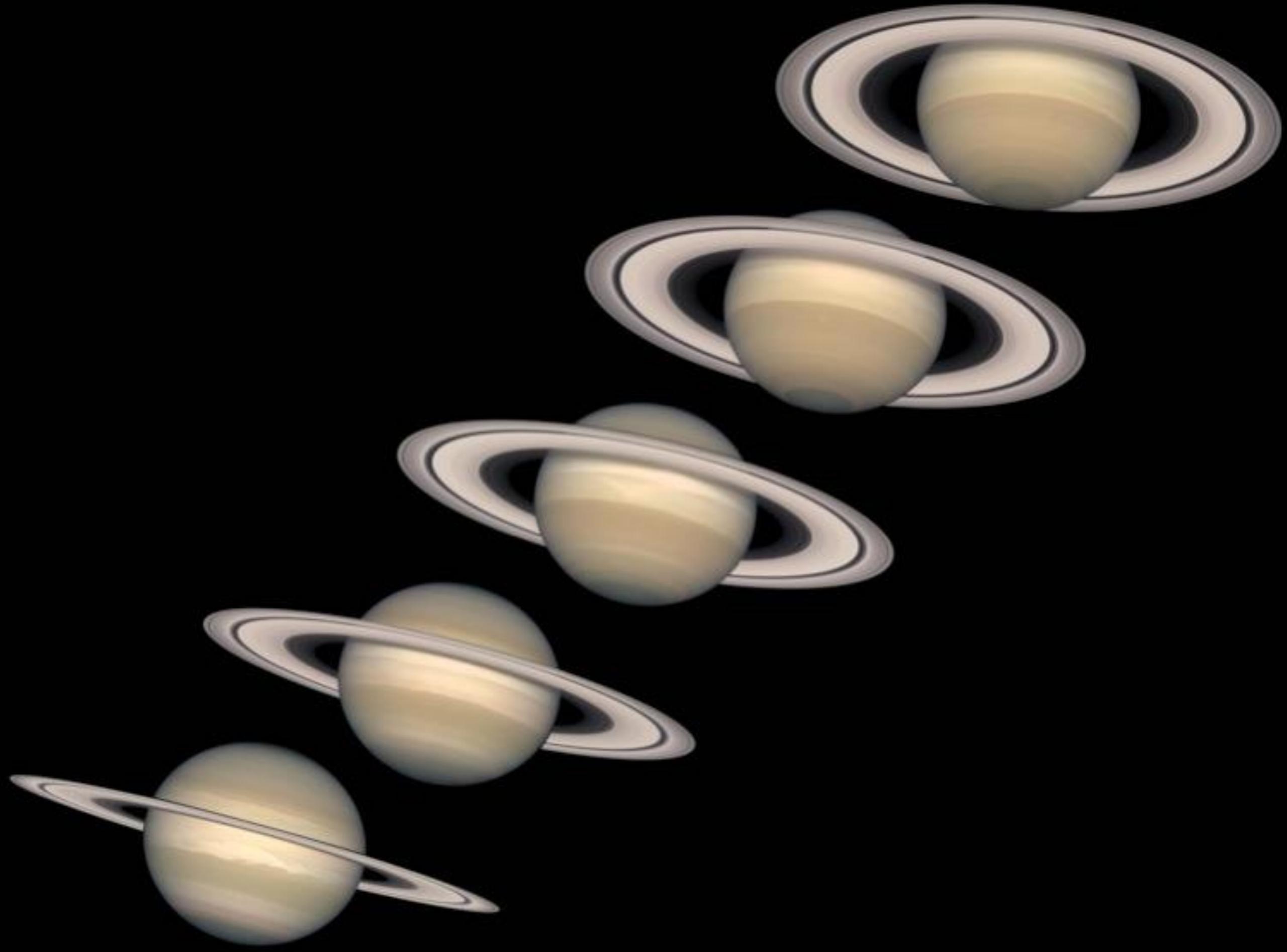
- A. 5
- B. 10
- C. 20
- D. 30

Saturn

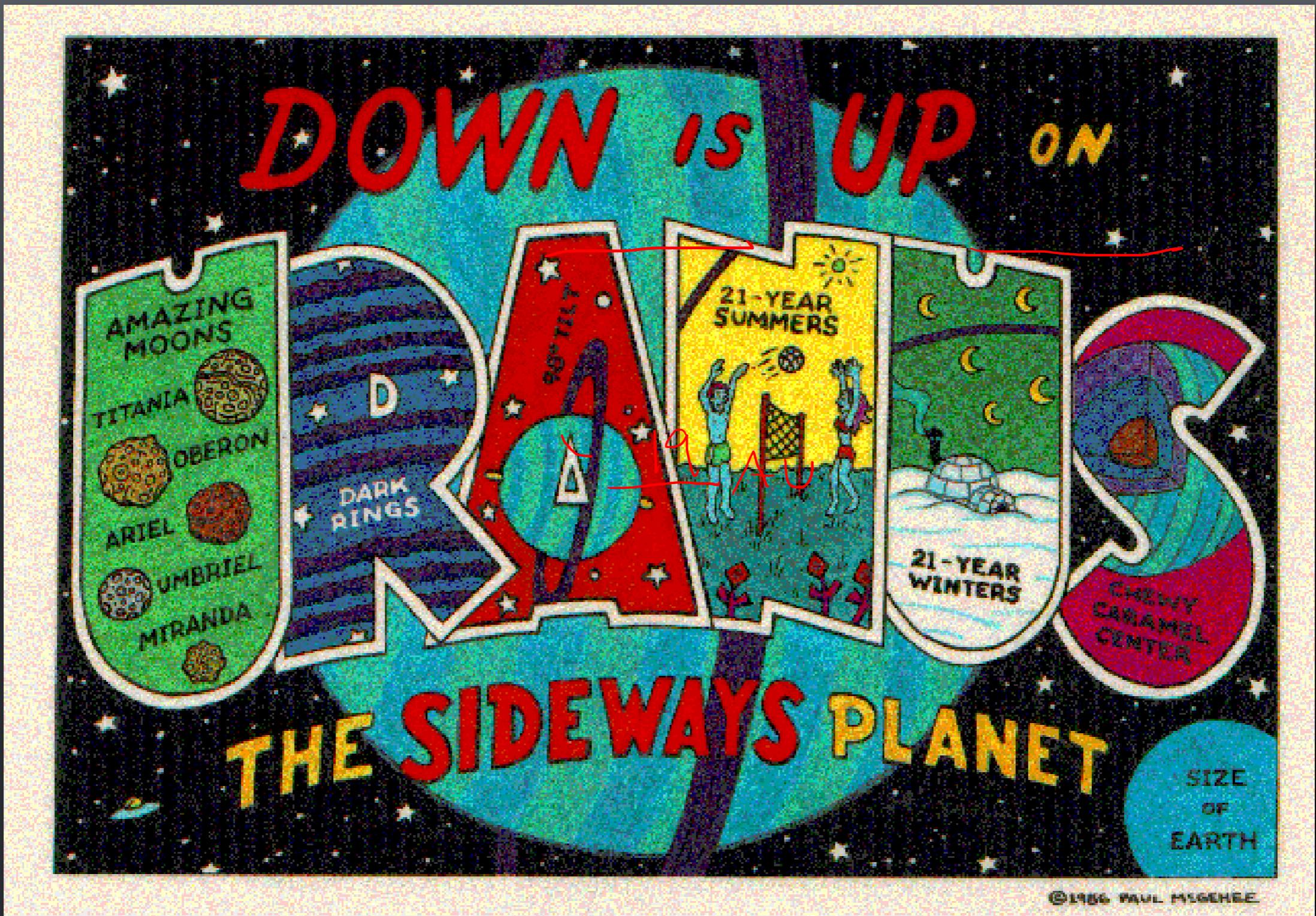
Temp $\sim 288^{\circ}\text{F}$

62 moons



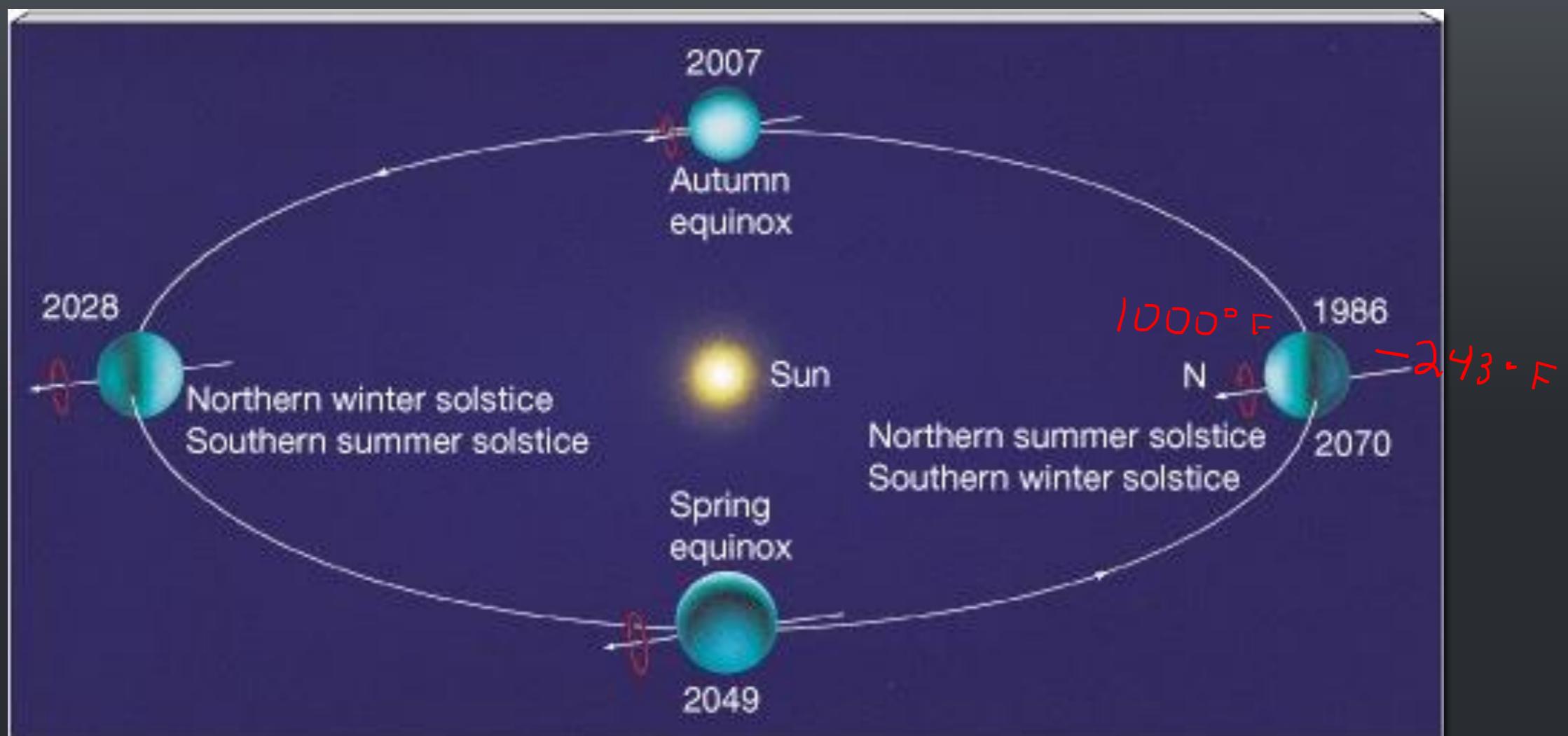


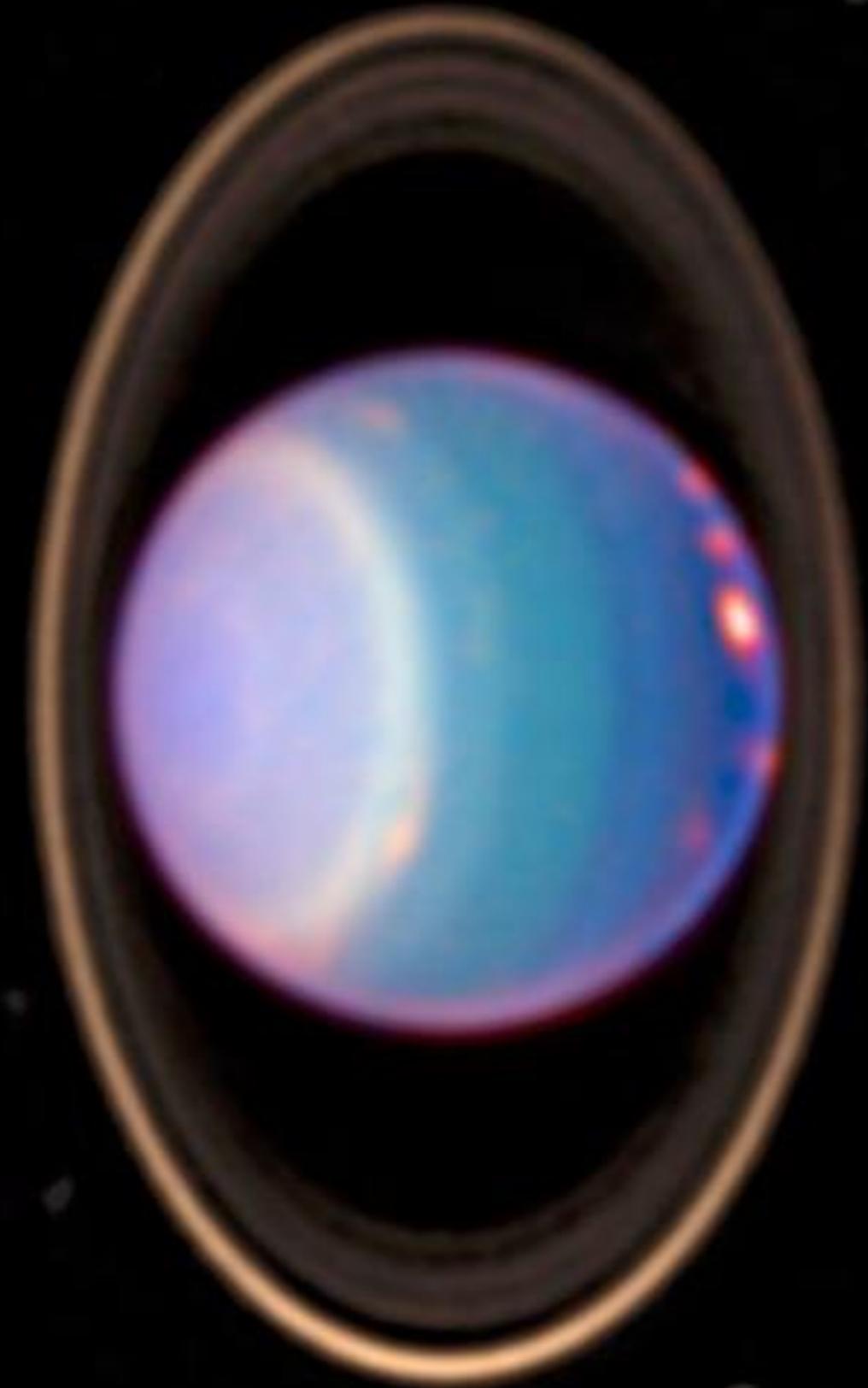
Uranus



The Tilted Planet

- Uranus is turned over on its side.





~17 moons

Neptune





13 moons

- 392° F

Zoom poll

Which two planets account for over 90% of the planetary mass in the Solar System?

- A) Venus and the Earth
- B) Mars and Jupiter
- C) Jupiter and Saturn
- D) Uranus and Neptune

How much mass is in all the planets of
the Solar System when compared to
the Sun?

- A. About 40%
- B. About 10%
- C. About 1%
- D. About 0.1%

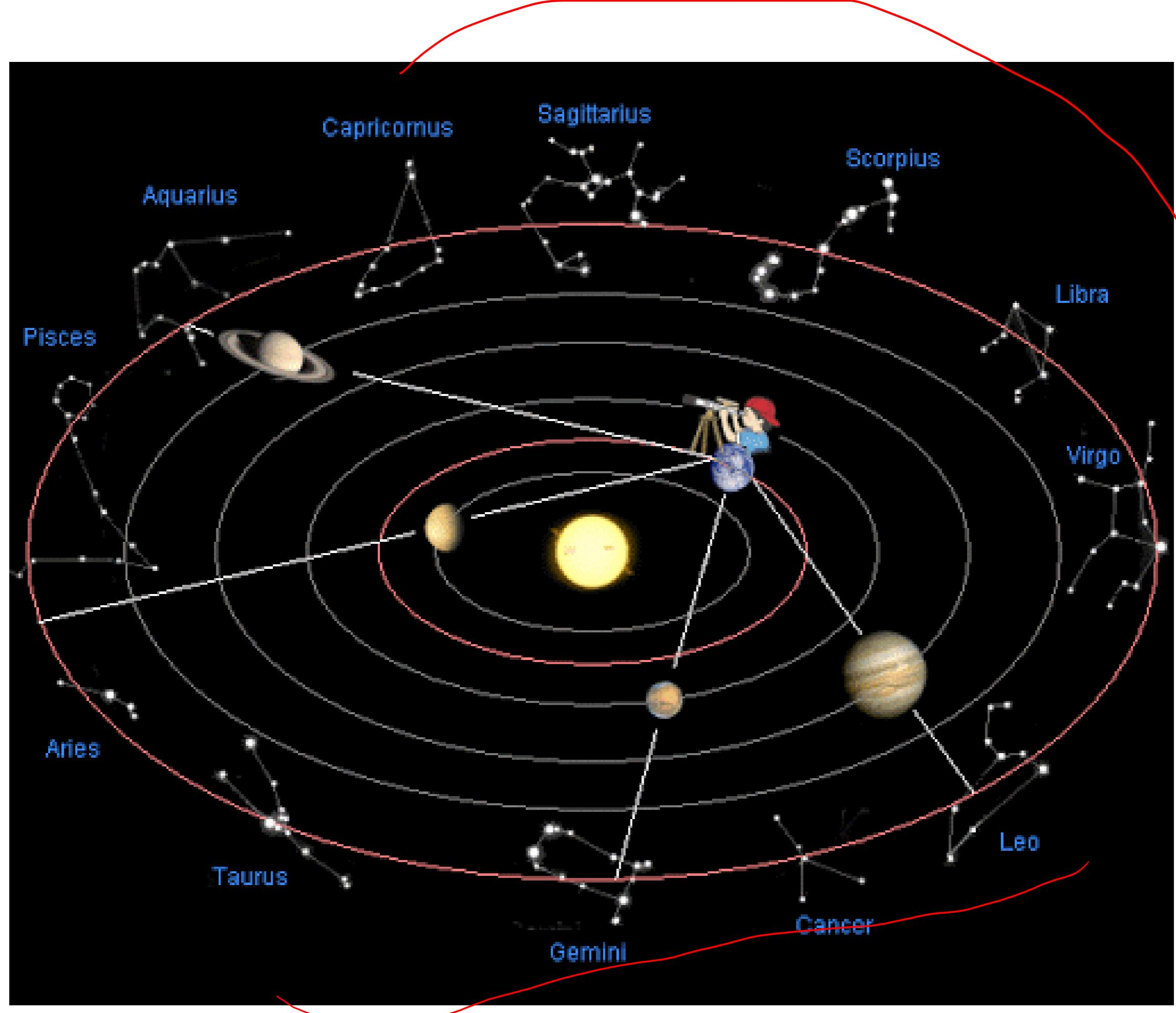
The planets' orbits around the Sun
are...

- A. Highly inclined with respect to one another
- B. On nearly the same plane
- C. Nearly circular
- D. Highly elliptical

select all that apply

The further from the Sun a planet is the
_____ its revolution (orbital period).

- A. longer
- B. shorter



The Evening Sky Map

FREE* EACH MONTH FOR YOU TO EXPLORE, LEARN & ENJOY THE NIGHT SKY

Sky Calendar – September 2020

- 2 Full Moon at 5:22 UT.
- 6 Moon near Mars (morning sky) at 6h UT. Mag. -1.9. Occultation visible from central South America.
- 6 Moon at apogee (farthest from Earth) at 6h UT (distance 405,607 km; angular size 29.5').
- 9 Moon near the Pleiades at 0h UT (morning sky).
- 9 Moon near Aldebaran at 18h UT (morning sky).
- 10 Last Quarter Moon at 9:27 UT.
- 13 Moon near Castor (morning sky) at 0h UT.
- 13 Moon near Pollux (morning sky) at 5h UT.
- 13 Venus 2.3° S of Beehive cluster M44 (43° from Sun, morning sky) at 10h UT. Mag. -4.1.
- 14 Moon near Beehive cluster M44 (44° from Sun, morning sky) at 5h UT.
- 14 Moon, Venus and Beehive cluster M44 within a circle of diam. 4.4° (44° from Sun, morning sky) at 6h UT. Mag. -4.1.
- 14 Moon near Venus (morning sky) at 7h UT. Mag. -4.1.
- 15 Moon near Regulus (morning sky) at 19h UT.
- 17 New Moon at 11:00 UT. Start of lunation 1209.
- 18 Moon at perigee (closest to Earth) at 13:55 UT (distance 359,082 km; angular size 33.3').
- 19 Moon near Mercury (23° from Sun, evening sky) at 3h UT. Mag. -0.1.
- 19 Moon near Spica (evening sky) at 10h UT.
- 22 Mercury 0.3° NE of Spica (24° from Sun, evening sky) at 12h UT. Mags. 0.0.
- 22 September equinox at 13:32 UT. The time when the Sun reaches the point along the ecliptic where it crosses into the southern celestial hemisphere marking the start of autumn in the Northern Hemisphere and spring in the Southern Hemisphere.
- 22 Moon near Antares (evening sky) at 14h UT.
- 24 First Quarter Moon at 1:55 UT.
- 25 Moon near Jupiter (evening sky) at 8h UT. Mag. -2.4.
- 25 Moon near Saturn (evening sky) at 22h UT. Mag. 0.4.

More sky events and links at <http://Skymaps.com/skycalendar/>

All times in Universal Time (UT). (USA Eastern Summer Time = UT - 4 hours.)

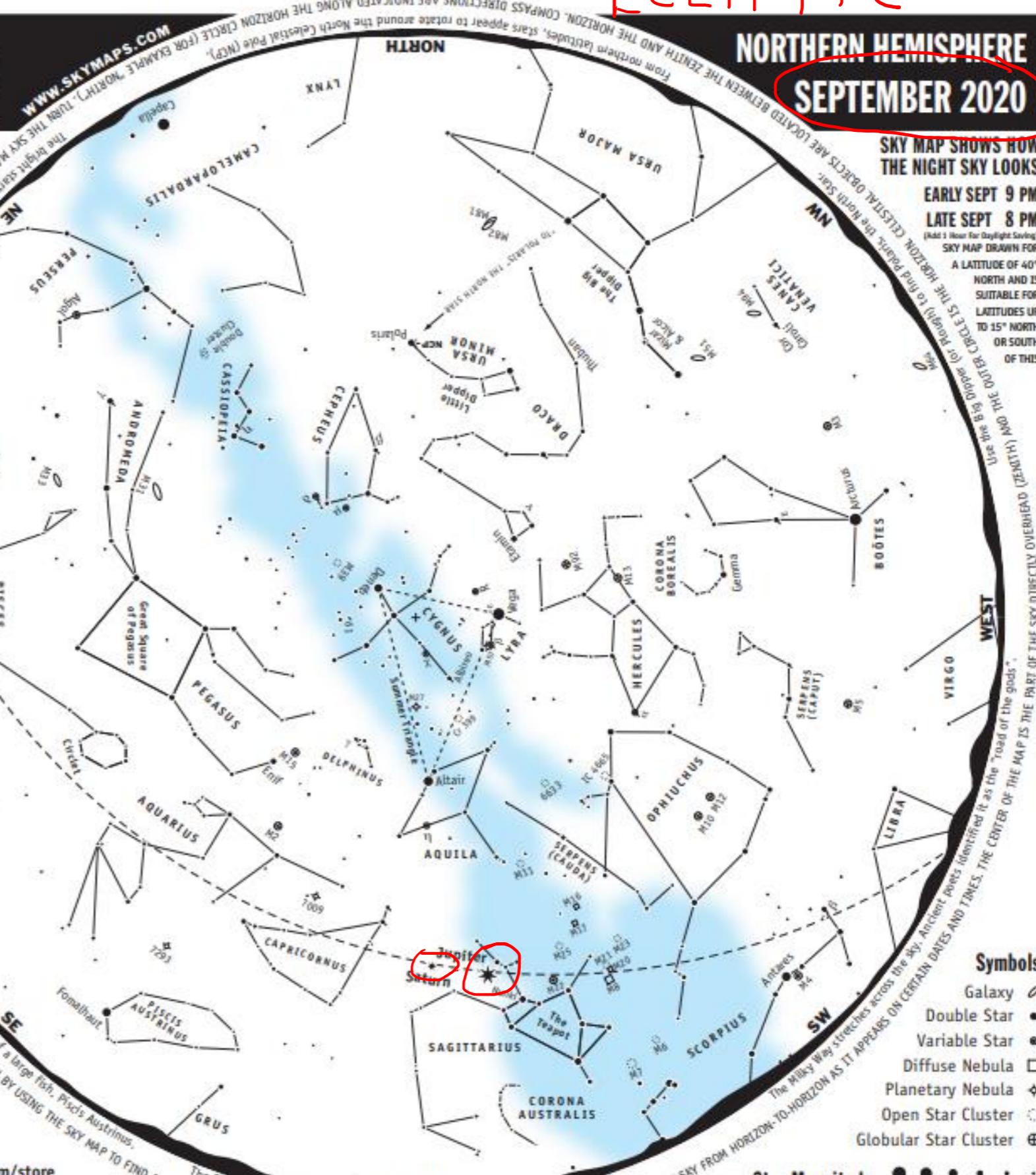


SAVE ON RECOMMENDED PRODUCTS • <http://Skymaps.com/store>

- STAR ATLASES & PLANISPHERES
- BOOKS FOR SKY WATCHERS
- STAR CHARTS & ASTRO POSTERS
- TELESCOPES & BINOCULARS

All sales support the production and free distribution of The Evening Sky Map.

Get Sky Calendar on Twitter
<http://twitter.com/skymaps>



Symbols

- Galaxy ○
- Double Star ●
- Variable Star ■
- Diffuse Nebula □
- Planetary Nebula ♦
- Open Star Cluster ○
- Globular Star Cluster ⊕

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ECLIPIC

Regulus (α Leo)

Jupiter

Mars

Venus

Magellan telescopes

 YURI
BELETSKY
Nighttime Astrophotography

Other Objects in the Solar System

- Asteroids
- Trans-Neptunian Objects
- Dwarf Planets
- Comets
- Meteoroids

Asteroids



- 100,000+ relatively small rocky objects mostly found in the ***Asteroid belt***
 - between Mars and Jupiter at distance of 2 – 3.5 AU
- Leftover objects that never got incorporated into building planets. Mostly made of *metal and rock* (they condensed within the frostline)
- Asteroids are cratered, most are oddly shaped
- (old nomenclature) The largest asteroid, **Ceres**, is round because it is so massive its gravity has shaped it into a **sphere**

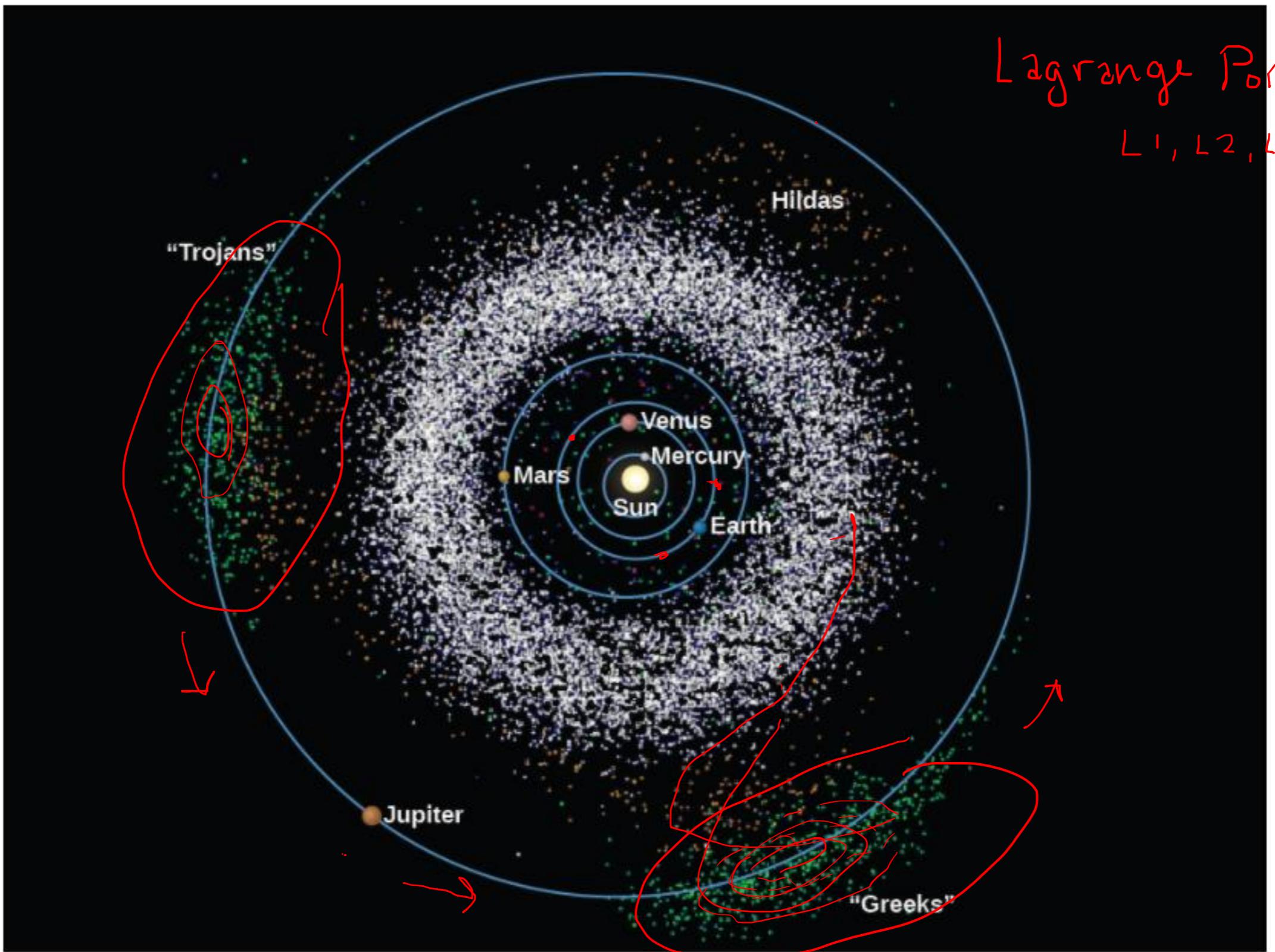


Figure 13.2 Asteroids in the Solar System. This computer-generated diagram shows the positions of the asteroids known in 2006. If the asteroid sizes were drawn to scale, none of the dots representing an asteroid would be visible. Here, the asteroid dots are too big and give a false impression of how crowded the asteroid belt would look if you were in it. Note that in addition to those in the asteroid belt, there are also asteroids in the inner solar system and some along Jupiter's orbit (such as the Trojans and Greeks groups), controlled by the giant planet's gravity.

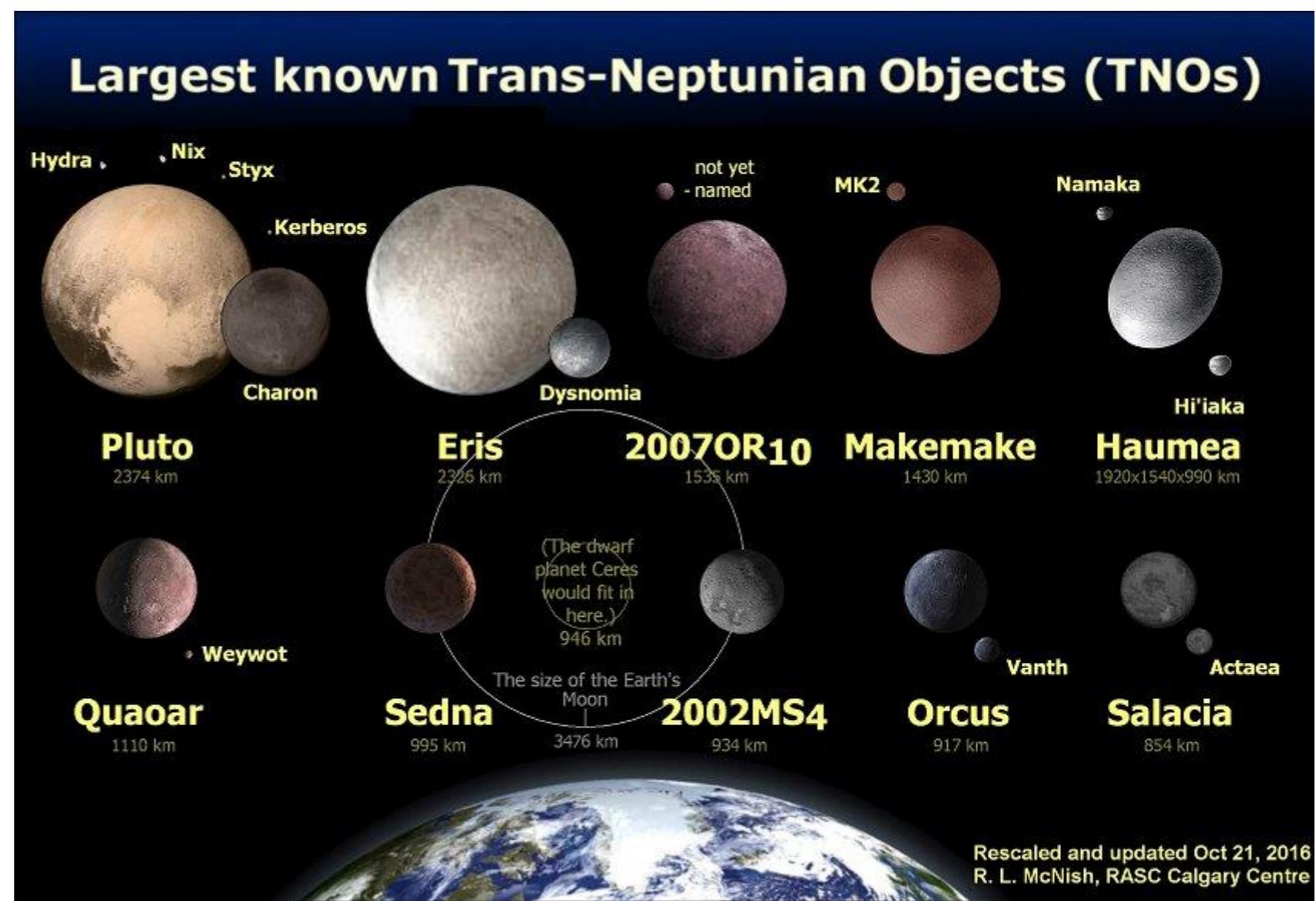
Participation Sept 24

Other Objects in the Solar System

Trans-Neptunian Objects

- Small objects that lie beyond the orbit of Neptune.

Largest of these are *dwarf planets*.
1st discovered is Pluto (1930).



That image of the Asteroid Belt you probably have in your head is wrong



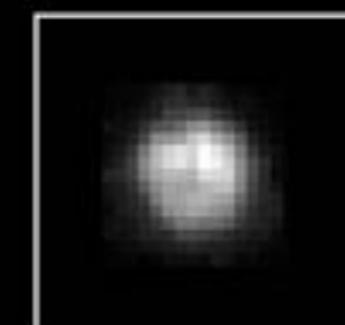
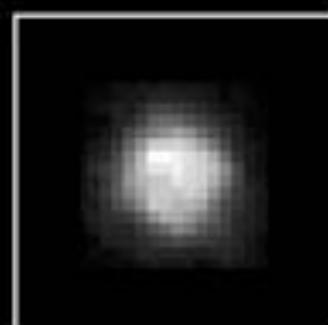
All asteroids are less than 1,000 km across
Typical asteroids are 1,000,000 km apart
The odds of successfully navigating an asteroid belt are... very good

Asteroid discoveries since the 1980s

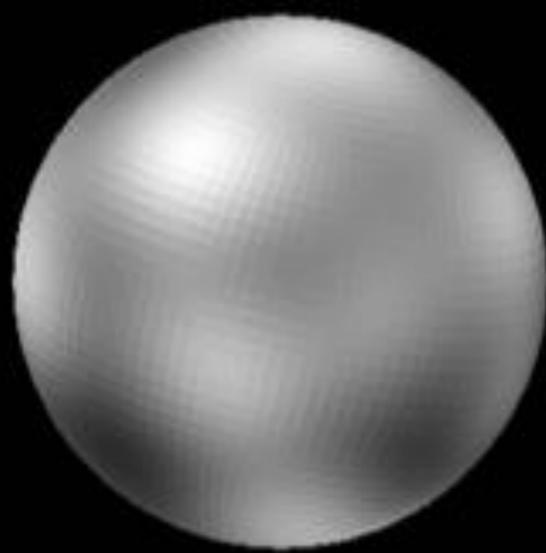
[https://www.youtube.com/w
atch?v=S_d-gs0WoUw](https://www.youtube.com/watch?v=S_d-gs0WoUw)

Pluto

- Pluto is tiny. It is only 0.22% the mass of the Earth and a tenth the diameter.
- Its orbit is also different. It is very elliptical and at an angle to the orbits of the other planets.
- Pluto is, on average, about 40 AU from the Sun. It takes 248 years to complete an orbit.
- Pluto has a relatively large moon, named Charon. Four additional, smaller moons have also been discovered!



Pluto



Earth

12,756 km
(7,920 miles)

Pluto

Hubble Space Telescope • Faint Obj

- From the textbook

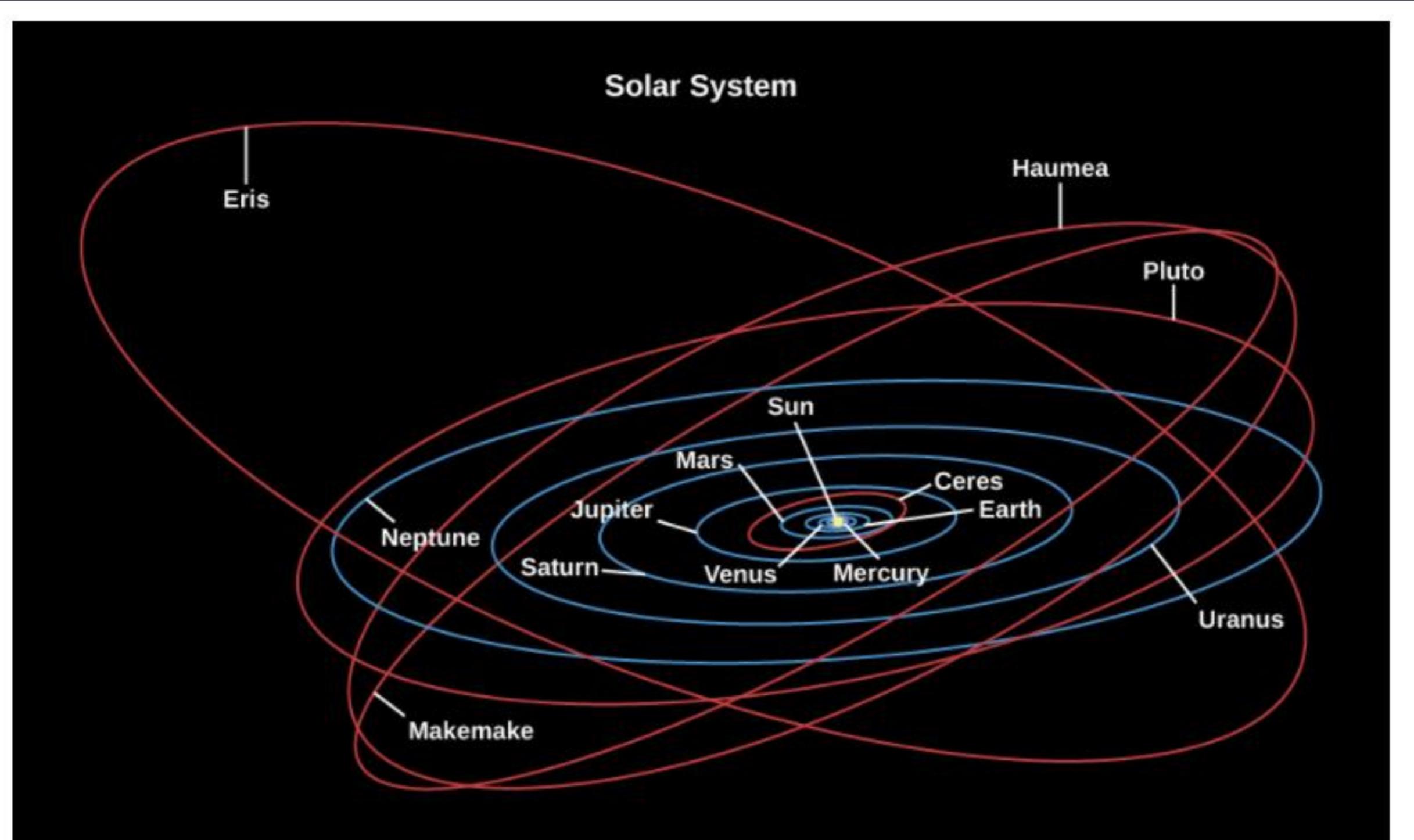
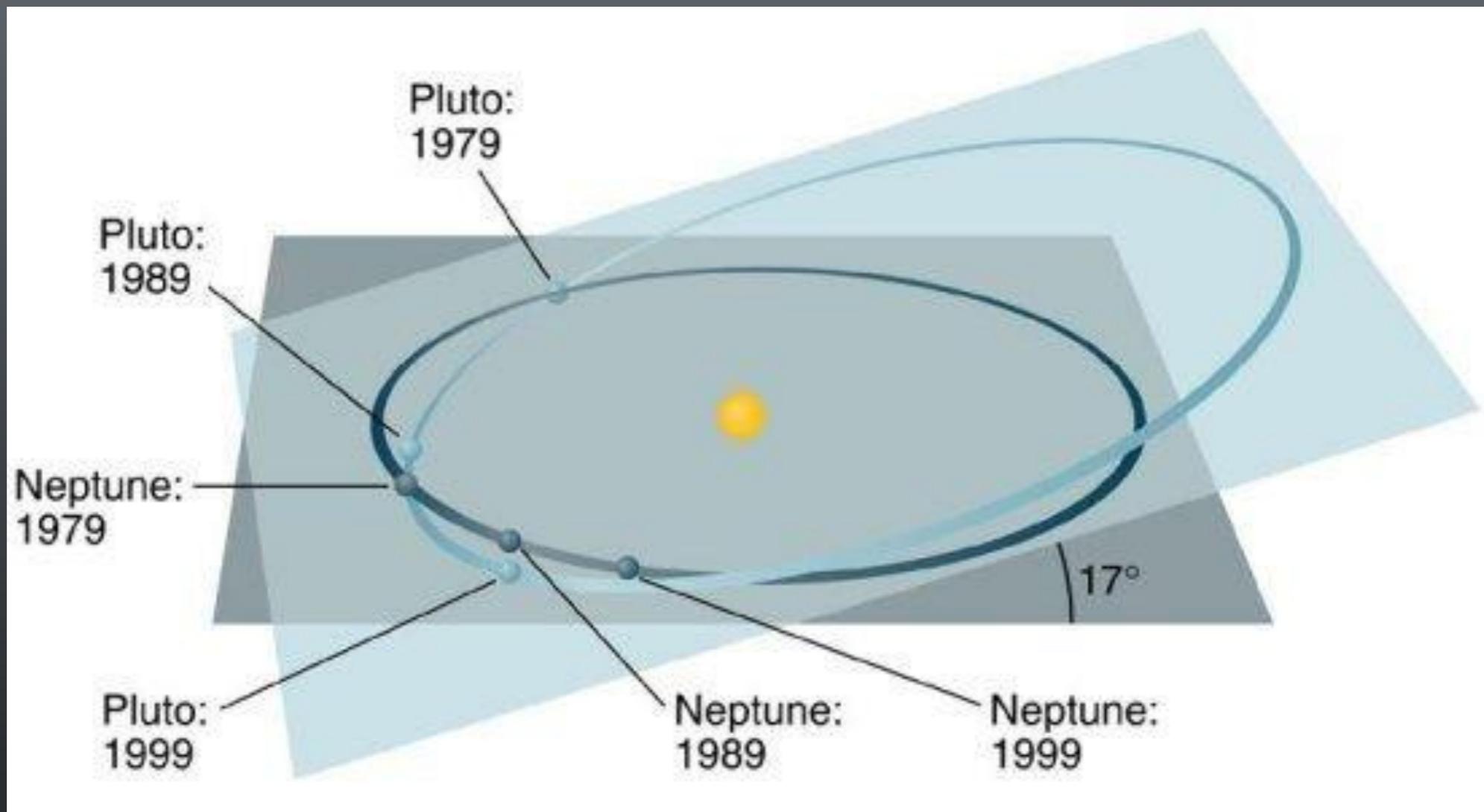


Figure 7.3 Orbits of the Planets. All eight major planets orbit the Sun in roughly the same plane. The five currently known dwarf planets are also shown: Eris, Haumea, Pluto, Ceres, and Makemake. Note that Pluto's orbit is not in the plane of the planets.

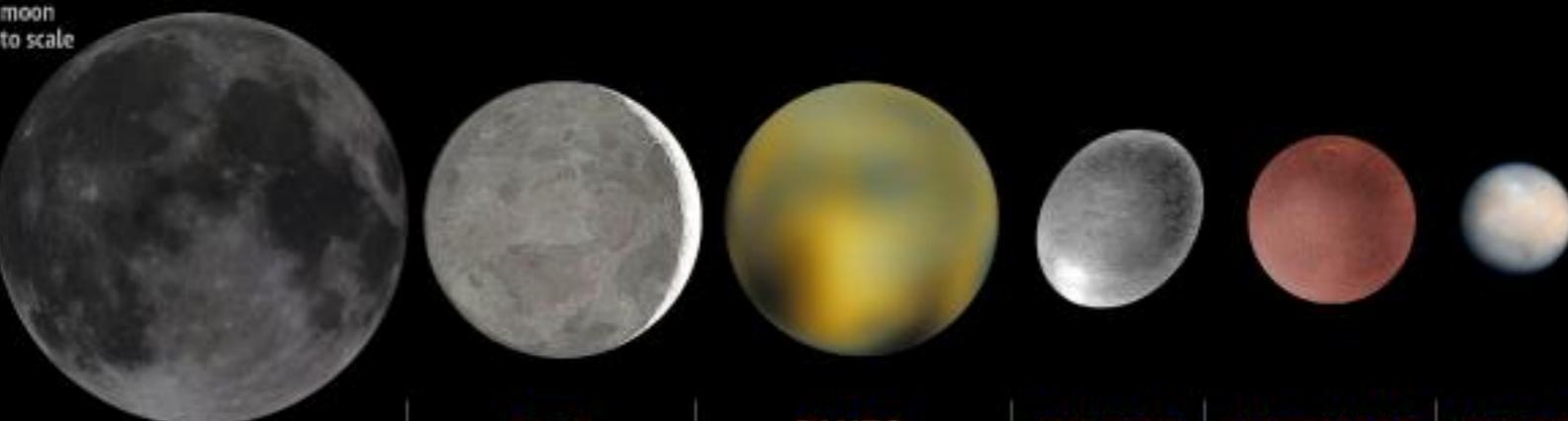


- The next time Pluto will closer to the Sun than Neptune (again) will be 2227.

Dwarf Planets in the Solar System

In 2006, the organization responsible for classifying celestial bodies, the International Astronomical Union (IAU) decided that a new class of objects was needed. Pluto, considered a planet since its discovery in 1930, was reclassified into the new “dwarf planet” category. To date, five dwarf planets have been found, although some astronomers expect there may be as many as 50 in the solar system.

Earth's
moon
to scale



	ERIS	PLUTO	HAUMEA	MAKEMAKE	CERES
Year of discovery	2003	1930	2003	2005	1801
Diameter (mean)	1,445 miles 2,326 km	1,430 miles 2,302 km	892.3 miles 1,436 km	882 miles 1,420 km	591.8 miles 952.4 km
Orbital period (Earth years)	561.4	247.9	281.9	305.34	4.6
Distance from sun (times Earth's distance)	68	39.5	43.1	45.3	2.8
Orbital inclination (degrees)	46.9	17.14	28.2	29	10.59
Rotation period	25.9 hours	6.39 Earth days	3.9 hours	22.5 hours	9.1 hours
Moons	1	5	2	0	0

OMG, You Killed Pluto!

Ques
plane

- Other dwarf planets
- In 2006, the IAU defined a planet as a body that orbits the Sun, is massive enough to assume hydrostatic equilibrium (nearly round), and has cleared its neighborhood.
- Pluto was reclassified as a dwarf planet.
- There are currently 14 known dwarf planets.

In August 2006, the International Astronomical Union (IAU) voted to define what it means to be a planet. The resulting criteria reclassified Pluto as a "dwarf planet."

- These objects are known as Trans-Neptunian Objects. TNOs are 30-100 AU from the Sun.

Planet vs. Dwarf

Planet

Question: What does it mean to be a planet?

The IAU agreed upon three criteria:

- The object must orbit the Sun.
- It must be big enough for its gravity to pull itself into a (nearly) spherical shape.
- It has “cleared the area” in its neighborhood. Objects which have not will be called “dwarf planets”.

All other objects that orbit the Sun will be called “Small Solar System Bodies.”



IAU XXVIII
General
Assembly



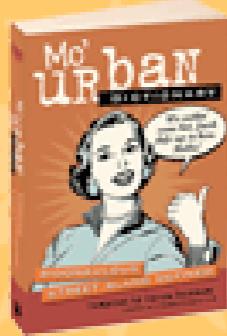


start calling pluto
an asteroid....

and it starts acting
like one.

paid for by the friends of pluto





[order mo' urban](#)
on amazon and b&n
now shipping

plushy
Plusical
plusplus
plust
plustard
pluswhich
pluswon
Plut
pluta(o)
plutch
Plute
plutepoopsex
pluther
pluthera
pluto
pluto fo sho
pluto water
Pluto'd
plutocracy
plutocrat

[plutoed](#)

[plutoed](#) [demoted](#) [pluto](#)

1. plutoed

93 up, 33 down

to be demoted without due cause or reason

I was captain of the ship for one day, but then I was plutoed.

tags [demoted](#) [promoted](#) [pluted](#) [pluted](#) [denounced](#)

by [DkLdAp](#) US Dec 12, 2006 [email it](#)

2. plutoed

49 up, 9 down

"to demote or devalue someone or something WITH considerable cause."

- from the root word [pluto](#), a name of a former planet, which was demoted and designated as 134340,(dwarf planet) because it didn't meet its definition of a Planet.

An employeed was [plutoed](#) from his company, for his wrongdoings.

tags [plutoed](#) [pluto'd](#) [pluto](#) [demoted](#) [planet](#) [devalue](#)

by [CyberJake](#) Pinoy Tambayan, Manila Jan 8, 2007 [email it](#)

3. plutoed

3 up, 6 down

to demote someone WITH considerable cause

A 2LT was PLUTOED from RL1 to RL3 because he couldn't start the engines.



White Print for Dark Color Shirts



Click on the image to change
image

Click on the colors shown above to change the color combination.
When you have finished experimenting with your selections in the pull down menu, click the 'Submit' button.

[Pluto Never Forget T-shirt](#) \$15.00/ea

#1) Size:



Seen On 6

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- [Irresistible News](#)
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[Homepage](#) > **ORLANDO NEWS**

Disney Performer Killed By Parade Float

Authorities Investigating Incident

POSTED: 3:54 pm EST February 11, 2004

UPDATED: 6:59 am EST February 12, 2004



ORLANDO, Fla. — A costumed worker dressed as the character Pluto was killed after being run over and killed by a Walt Disney World float during an afternoon parade Wednesday, according to Local 6 News.

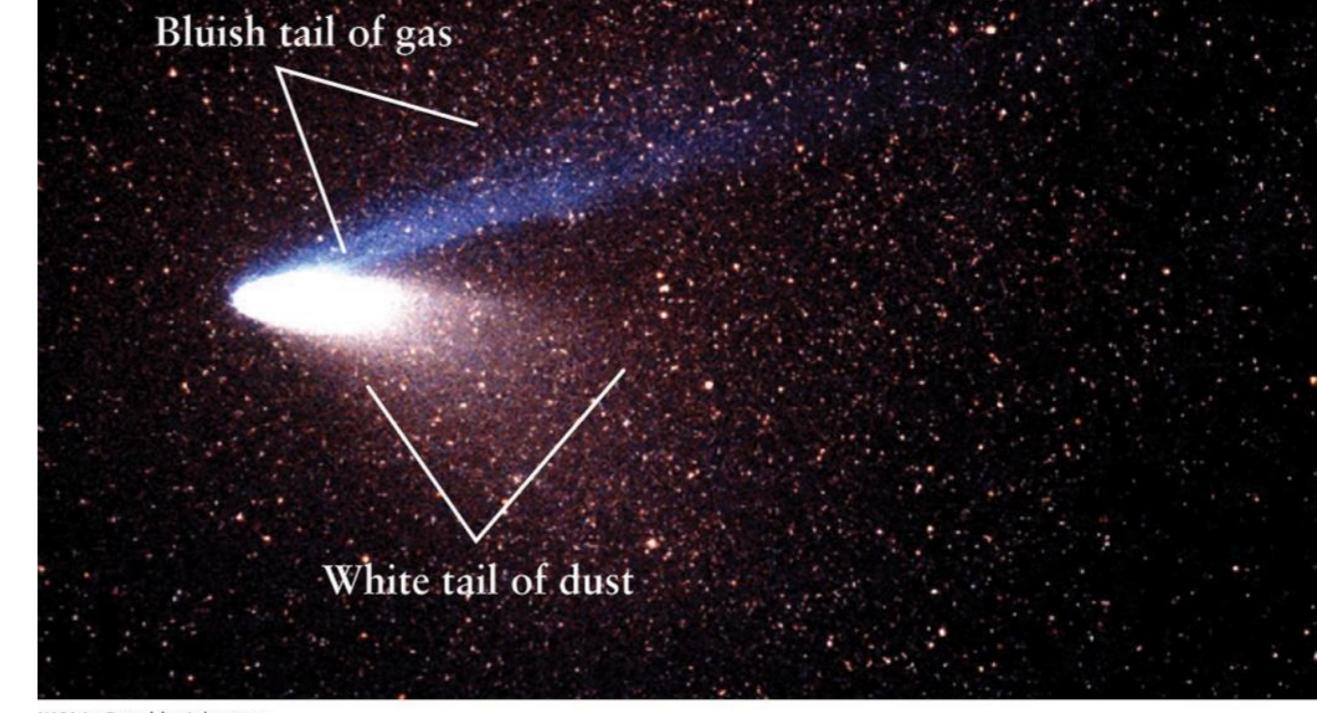


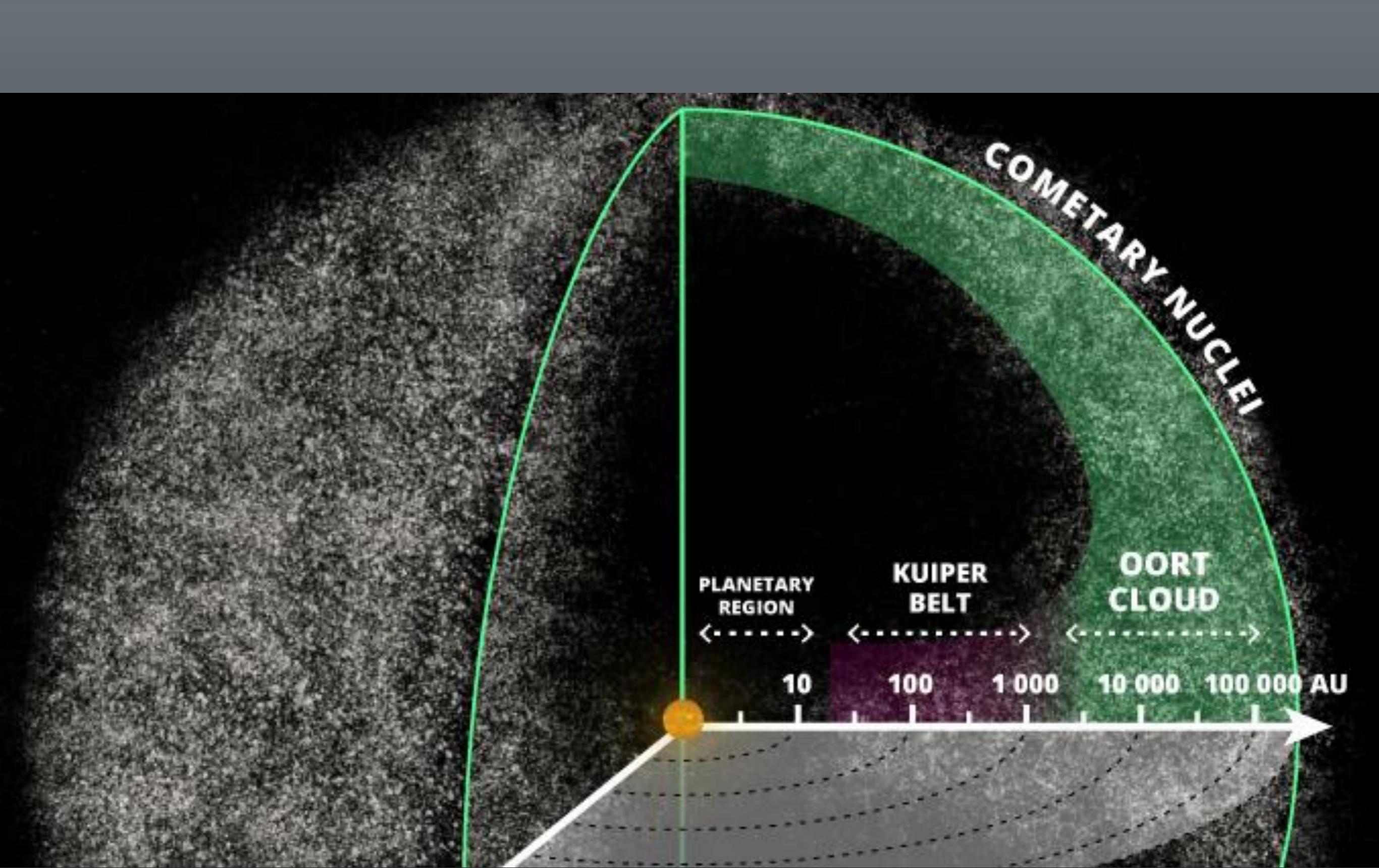
Javier Cruz, 38, of Orlando was killed in a backstage area of the Magic Kingdom, near the Splash Mountain ride, according to the Orange County Sheriff's Office. Cruz had worked at the park for eight years, officials said.

Other Objects in the Solar System

- **Comets**

- Leftover planetesimals that formed beyond the frost line, so they mostly consist of ice and rocky dust. Often called “dirty snowballs”
- Come from the Kupier belt or Oort cloud. Most likely made from by a collision of two trans-neptunian objects. A fragment of a collision can be diverted into a new and elongated orbit that brings it close to the Sun.
- Small objects; nuclei no larger than 20 km across.





The Oort Cloud
5,000-100,000 A.U.

Sun

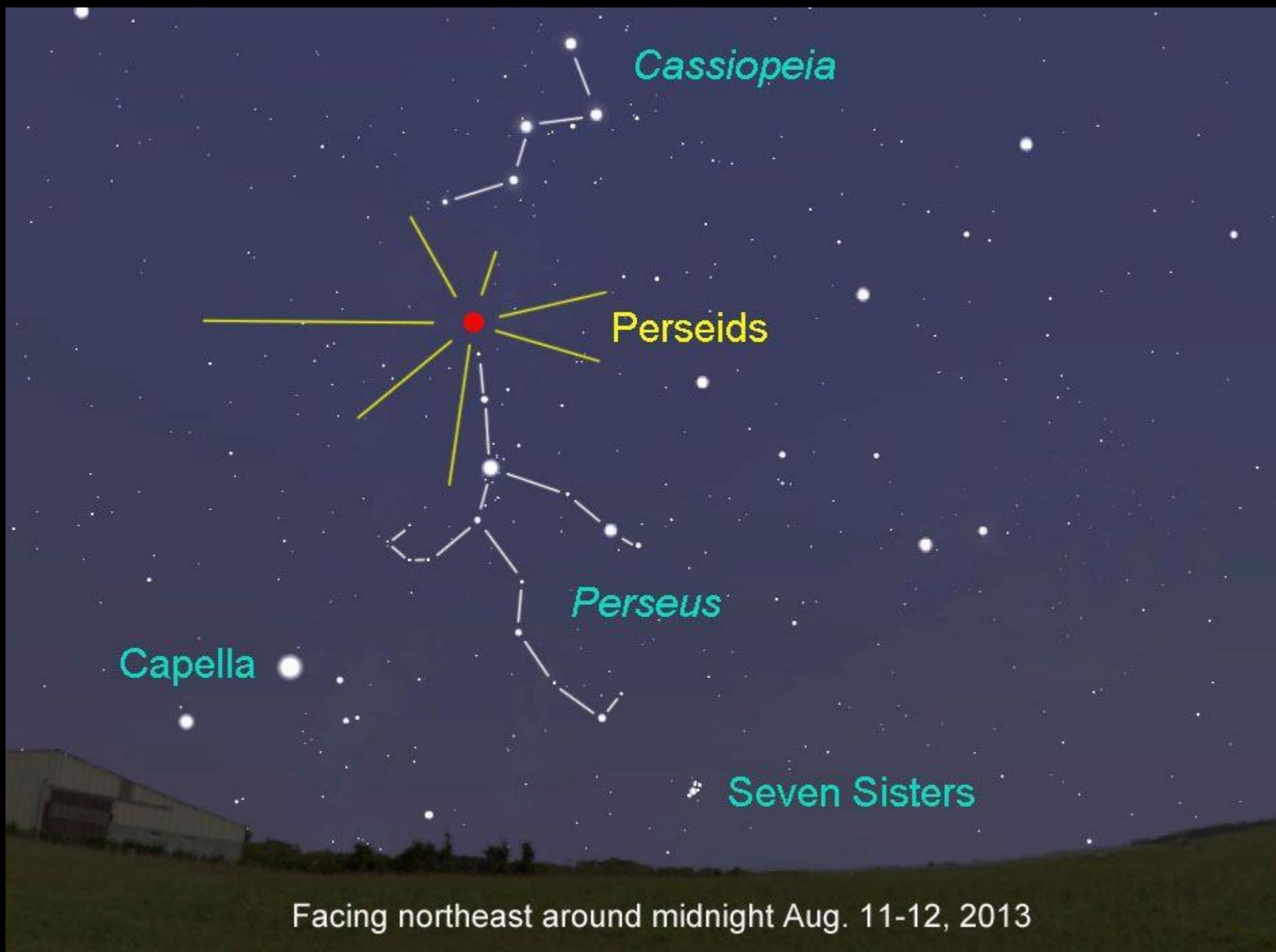


Kuiper belt



Comet Orbits

Relationship between comet orbits and meteor showers





Meteor Shower Dates

<https://www.almanac.com/content/meteor-shower-calendar>

Principal Meteor Showers					
SHOWER	BEST VIEWING	POINT OF ORIGIN	DATE OF MAXIMUM*	NO. PER HOUR**	ASSOCIATED COMET
Quadrantid	Predawn	N	Jan. 4	25	–
Lyrid	Predawn	S	Apr. 22	10	Thatcher
Eta Aquarid	Predawn	SE	May 4	10	Halley
Delta Aquarid	Predawn	S	July 30	10	–
Perseid	Predawn	NE	Aug. 11–13	50	Swift-Tuttle
Draconid	Late evening	NW	Oct. 9	6	Giacobini-Zinner
Orionid	Predawn	S	Oct. 21–22	15	Halley
Taurid	Late evening	S	Nov. 9	3	Encke
Leonid	Predawn	S	Nov. 17–18	10	Tempel-Tuttle
Andromedid	Late evening	S	Nov. 25–27	5	Biela
Geminid	All night	NE	Dec. 13–14	75	–
Ursid	Predawn	N	Dec. 22	5	Tuttle
*May vary by one or two days **Moonless, rural sky Bold = most prominent					

Other Objects in the Solar System

- **Meteoroids** – debris in the Solar System ranging in size from a grain of sand sized ones to boulder sized. When one enters Earth's atmosphere it is called a ***meteor*** (or shooting star) ; if it falls on the surface of Earth, it is called a ***meteorite***.

Astronomers discover a new object in our solar system, orbiting perpendicular to the ecliptic plane. This object is most likely a(n)

- A. asteroid.
- B. comet.
- C. planet.
- D. trans-Neptunian object

Astronomers discover a new object in our solar system, orbiting perpendicular to the ecliptic plane. This object is most likely a(n)

- A. asteroid.
- B. comet.
- C. planet.
- D. trans-Neptunian object

Asteroids, trans-Neptunian objects (same as Kupier belt objects), and planets all lie on or near the ecliptic. While comets can come from the Kupier belt, some can also come from the Oort cloud. Since the Oort cloud is spherical and not a plane, comets that come from this region can have orbits that are perpendicular to the ecliptic plane.

Moons are Natural Satellites

- All planets have moons, except Mercury and Venus.
- The outer planets have many more moons than the inner planets.
- Seven satellites are almost as big as the inner planets.

