

Chapter 2 Universe and Planetary Geology

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Questions

- Who is the first flight of man in the space? And who is the first man to set foot on the Moon?
- When did China became the third nation to independently launch an astronaut into Earth orbit ?
- What are the planets in the order of increasing distance from the Sun?
- Which planet in the solar system has the largest density? How much?
- What are the terrestrial planets and jovian planets?
- What is the law of gravitation?
- How about the Earth's shape?

2.1 The history of universe exploration

- Our interests in visible stars date back to prehistory. Romans named the planets after their gods: Saturn, Jupiter, Mars, Venues and Mercury.
- Chinese ancient religion also related gods with stars and planets. When we talk about the history of exploring space, we think about spaceship, satellite and rockets, etc.

2.1 The history of universe exploration

- **Rocket** → fire arrow made by Chinese before 1232 AD, for ceremonial...
- The first person to view the sky through a telescope was **Galileo**(伽利略) (1564—1642) in Italy in 1609.
- When the first artificial (man-made) satellite was placed in orbit around the Earth in 1957, a new science, **Planetology**(行星学), was born. From that moment on, man has studied planets mainly by means of spaceships.
- On April 12, 1961, former Soviet spaceship, Vostok, steered by **Gagarin** (1934—1968), flew into outer space. That is the first flight of man in the space.
- On July 21, 1969, the manned spacecraft Apollo 11 sent two astronauts to the Moon. And a new branch of sciences—**Planetary Geology**(行星地质学)—was born. **Armstrong, Neil** (1930—): “That’s one small step for a man, one giant leap for mankind”.
- **China**: June, 1964, first self-developed ballistic missile was launched;
Oct. 15, 2003, launching an astronaut into Earth orbit...
and a lot more!

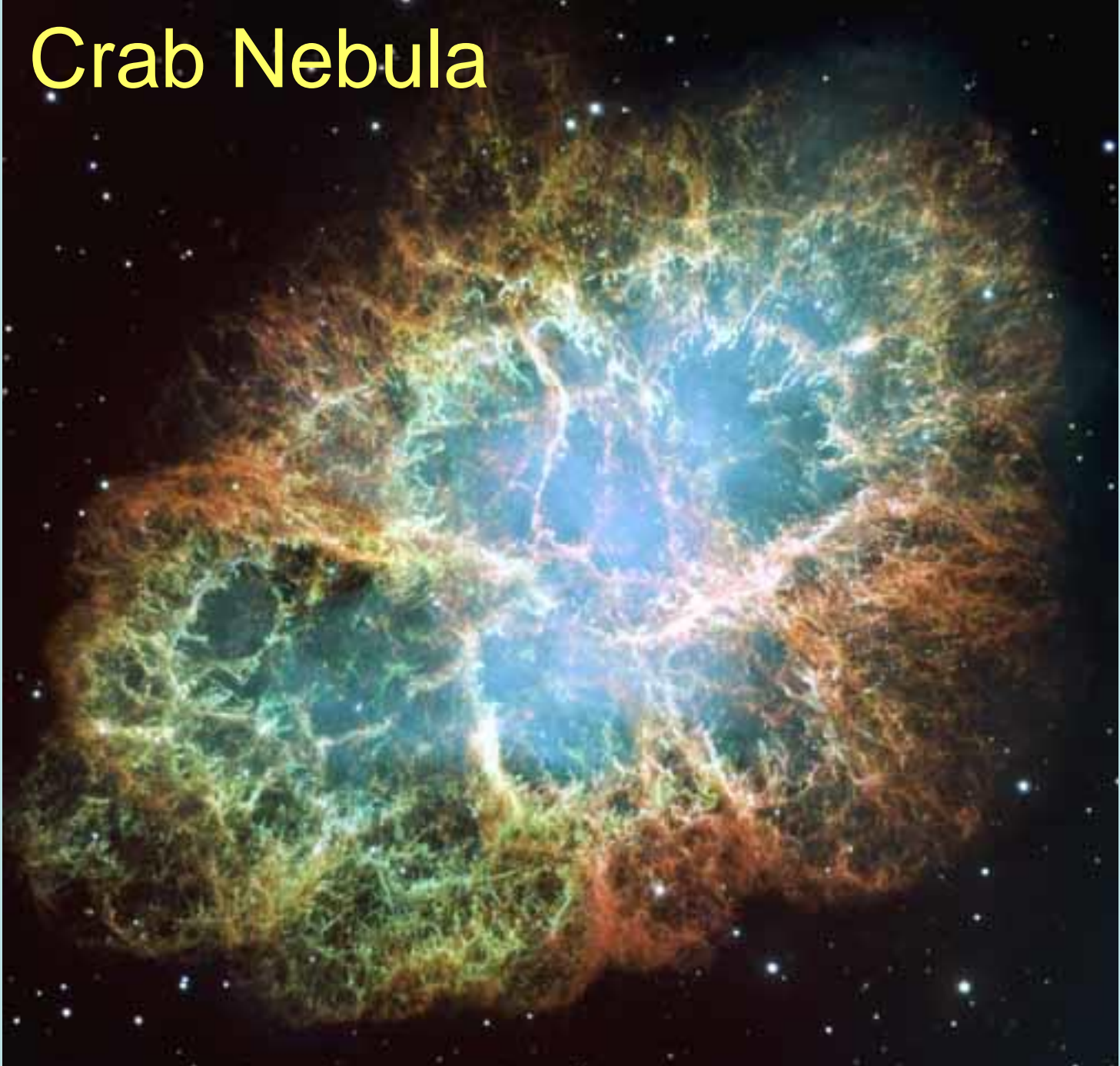
Basic definitions of Universe

- **Universe** (宇宙) means all space and the matter that exists in it.
- **Galaxy** (星系) indicates any of the large groups of stars that make up the universe. Our galaxy is called **Milky Way** (银河), written as Galaxy (银河) —the large group of stars in which our own sun and its planets lie.
- **Solar system** (太阳系) means the Sun together with the planets and other bodies going around it.

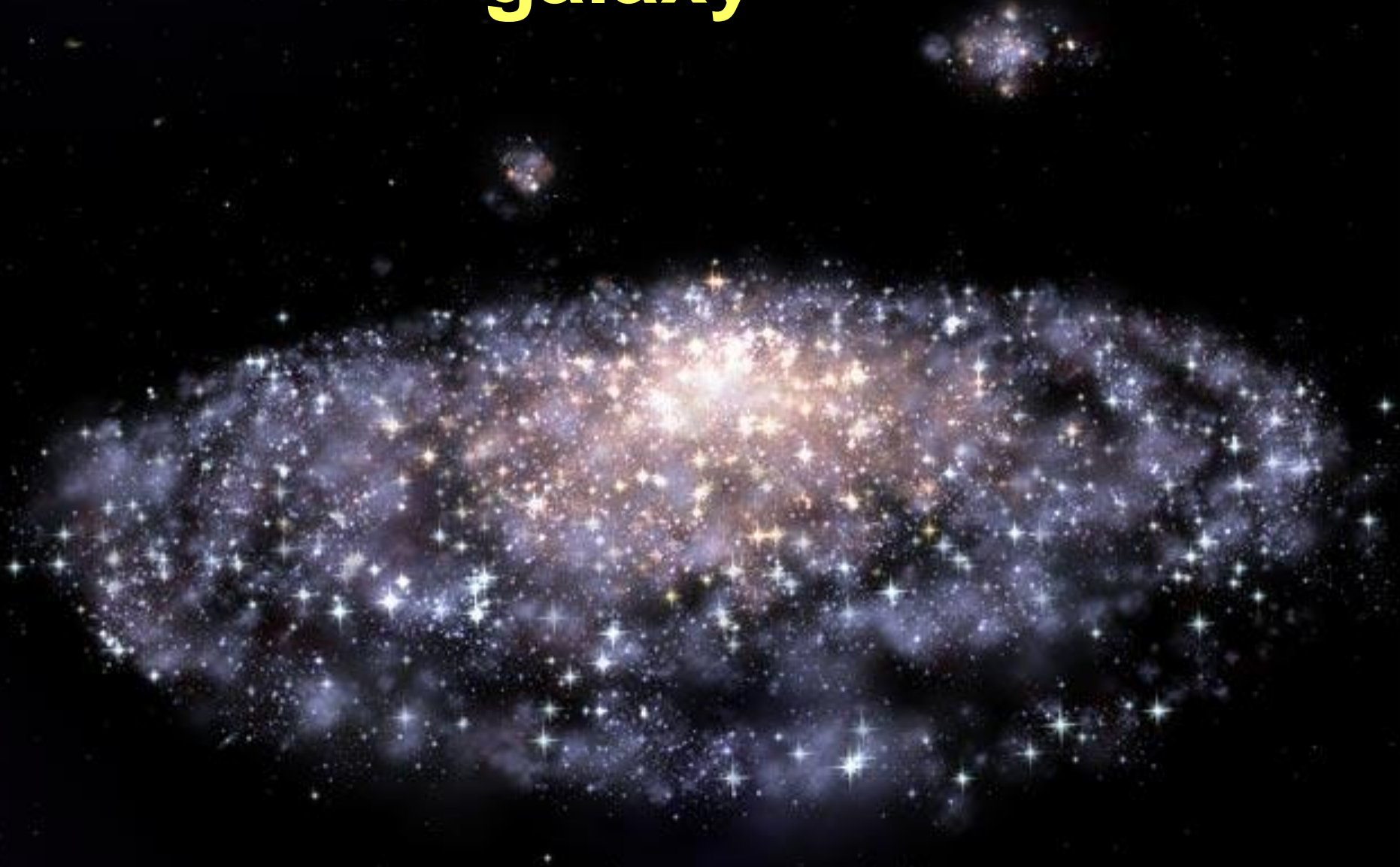
A part of the Universe



Crab Nebula



galaxy



<http://www.fpsoftlab.com/images/screenshots/galaxy-640x480-1.jpg>

Image of whirlpool galaxy M51



False-color composite image of Cartwheel galaxy



http://us.st12.yimg.com/us.st.yimg.com/l/spaceimages_2038_4771428

Milky Way



10 000 ly

<http://www.atlasoftheuniverse.com/milkyway.jpg>



Image of Milky Way viewed from the Earth

http://www.usbible.com/Astrology/milky_way.gif

Image of Milky Way viewed from the Earth



© 1986 Jerry Lodriguss and John Martinez

http://www.astropix.com/HTML/D_SUM_S/MILKYWAY.HTM

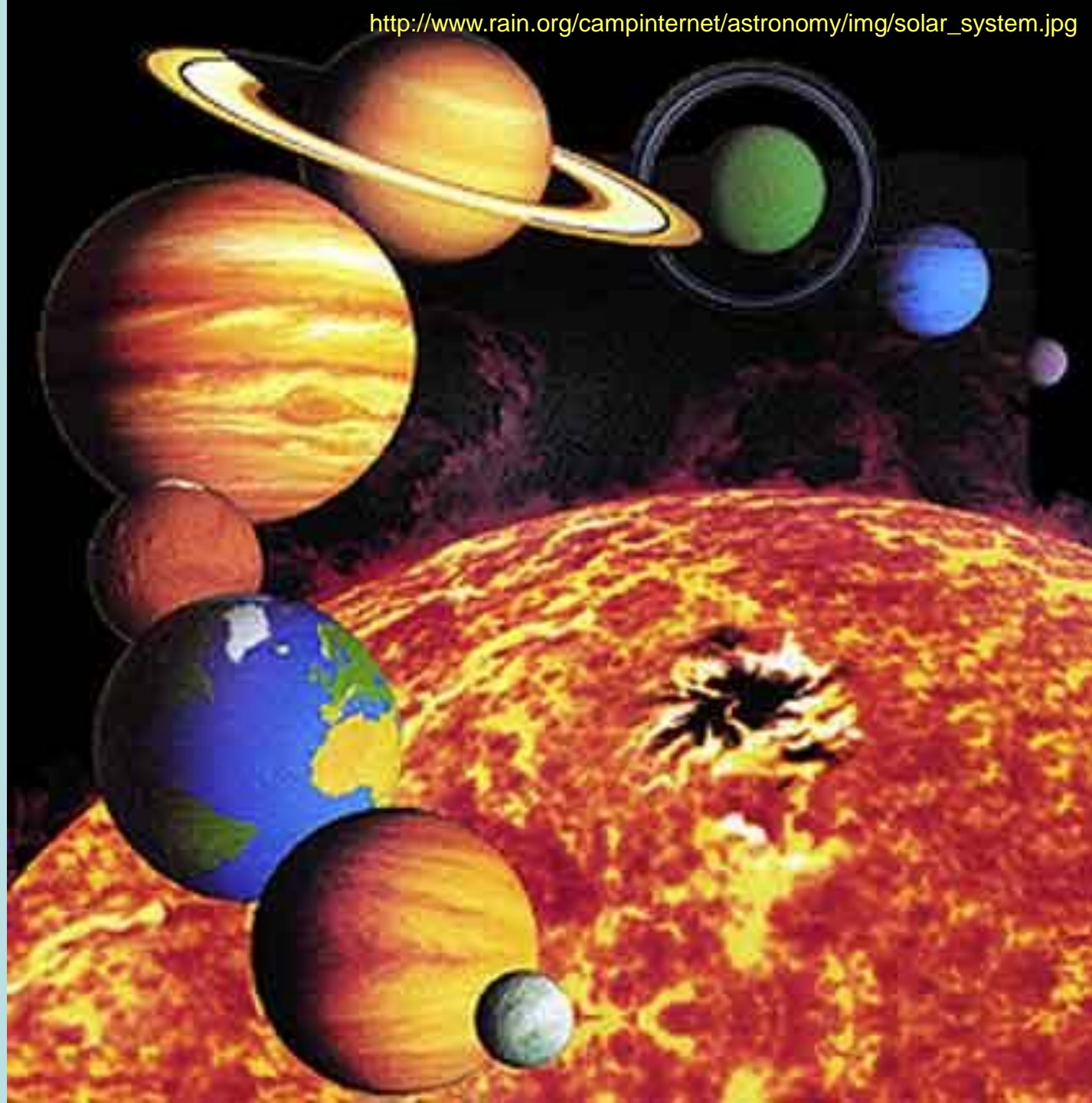
2.2 7 Members of the Solar System (太阳系的成员)

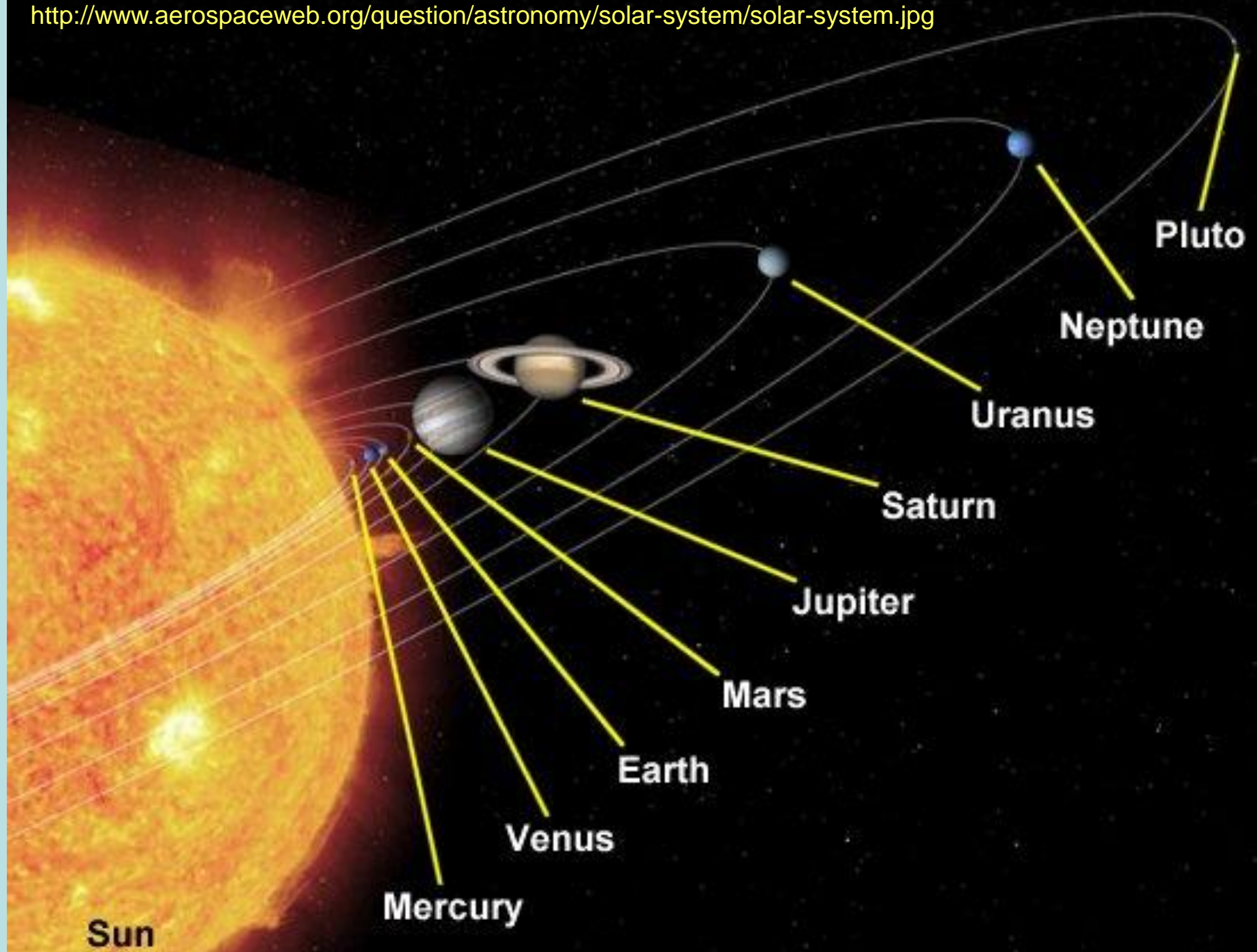
Members of the solar system include:

- **Sun** (太阳) -----Star (a fixed star), 99.87% mass of the system.
- **Planets** (行星) 0.134% mass.
- **Comet** (彗星)
- **Satellite** (卫星) (moon月亮), manmade satellite (人造卫星)
- **Asteroid** (小行星)
- **Meteorite** (陨星), **Shooting star** (流星) (falling star, meteoroid)
- **Cosmic dust** (宇宙尘)

Planets in the Solar System

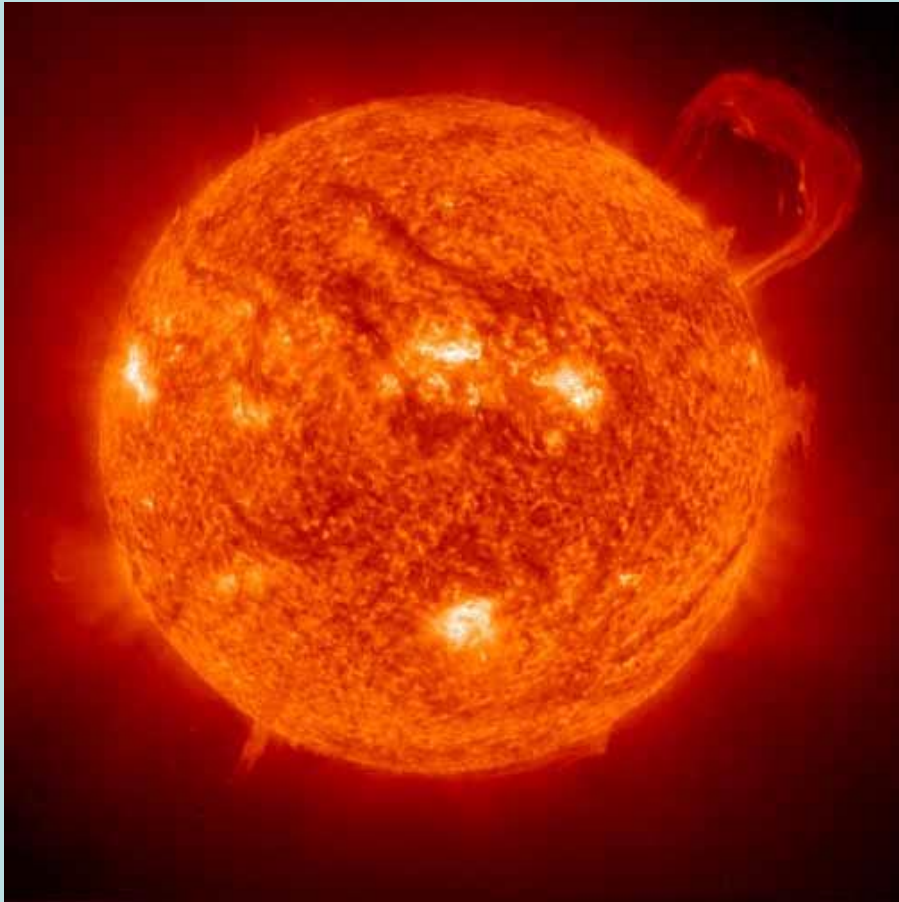






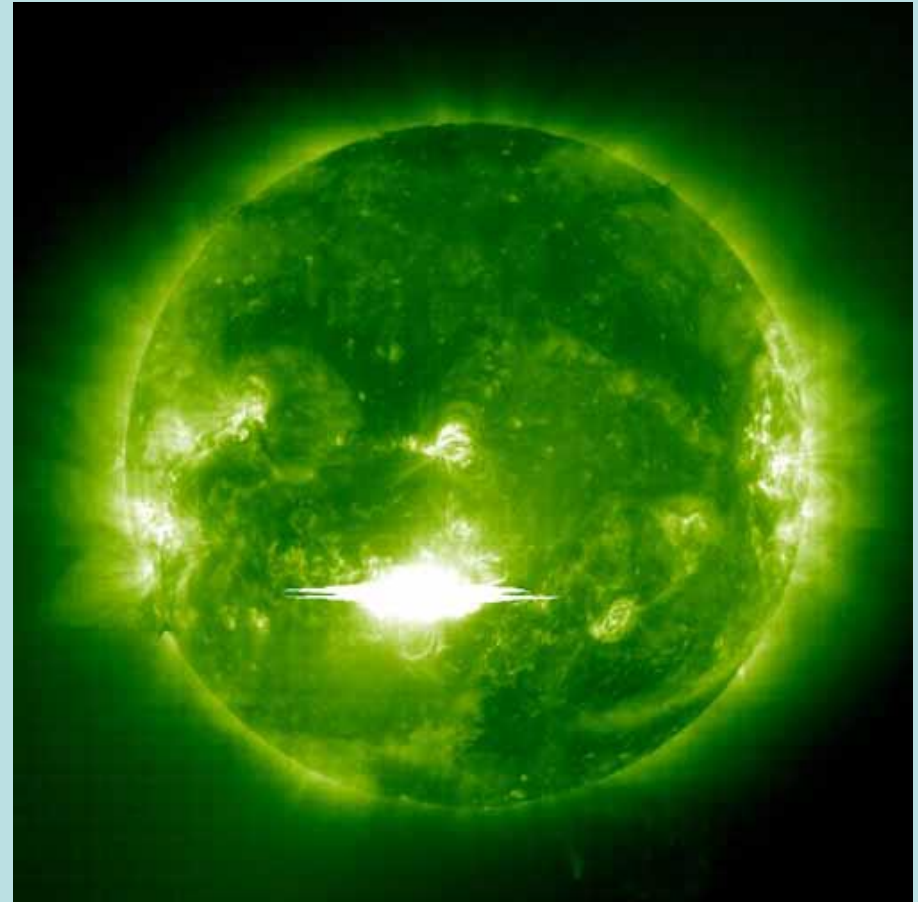
Images of Sun

Extreme Ultraviolet Imaging
Telescope (EIT) image



http://us.st12.yimg.com/us.st.yimg.com/l/spaceimages_2042_65121484

A major solar flare (太阳耀斑)



http://us.st12.yimg.com/us.st.yimg.com/l/spaceimages_2042_77126497

The Sun

The **Sun** is the most prominent feature in our solar system. It is the largest object and contains approximately 99% of the total solar system mass.

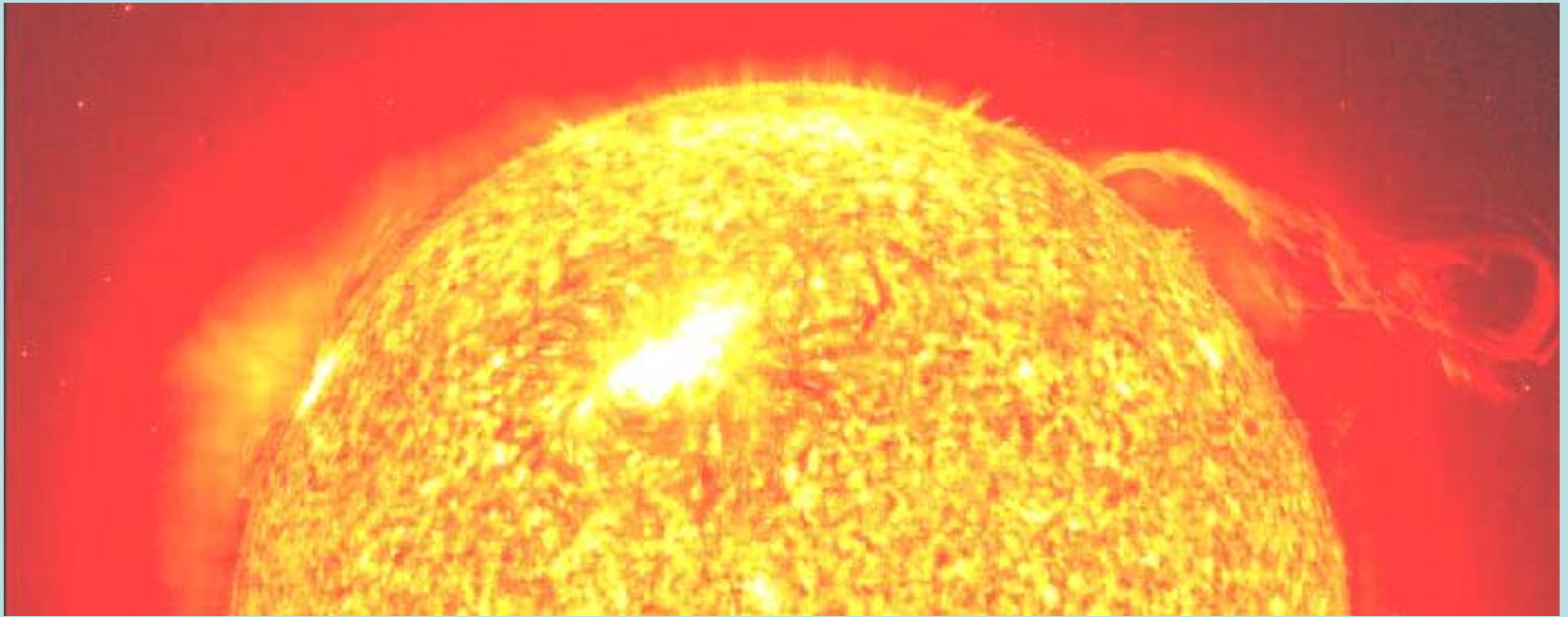


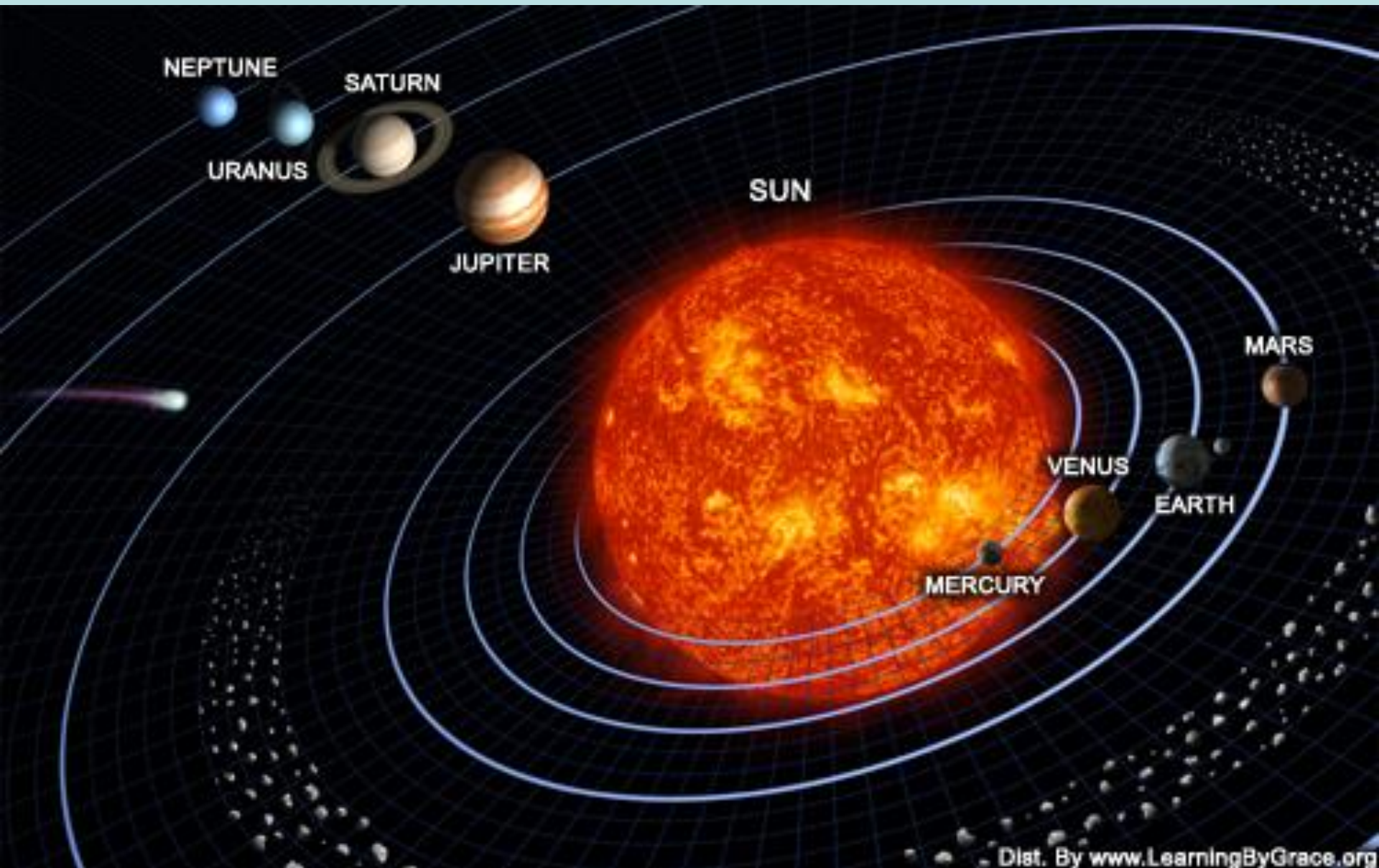
Fig. 2.5 The Sun's image (Modified from <http://seds.lpl.arizona.edu>)

2.2.1 Planet (行星)

A **planet** is any of the **celestial bodies** (天体) (other than comets or satellites) that revolve around the sun in the solar system. It is distinguished from a comet by the absence of a coma, and by having a less eccentric orbit.

The **orbits** of the planets are **ellipses** with the Sun at one focus, though all except Mercury and Pluto are very nearly circular. The orbits of the planets are all more or less in the same plane (called the **ecliptic** 黄道 and defined by the plane of the Earth's orbit). The ecliptic is inclined only **7** degrees from the plane of the **Sun's equator**. Pluto's orbit deviates the most from the plane of the ecliptic with an inclination of **17** degrees (Fig. 2.1).

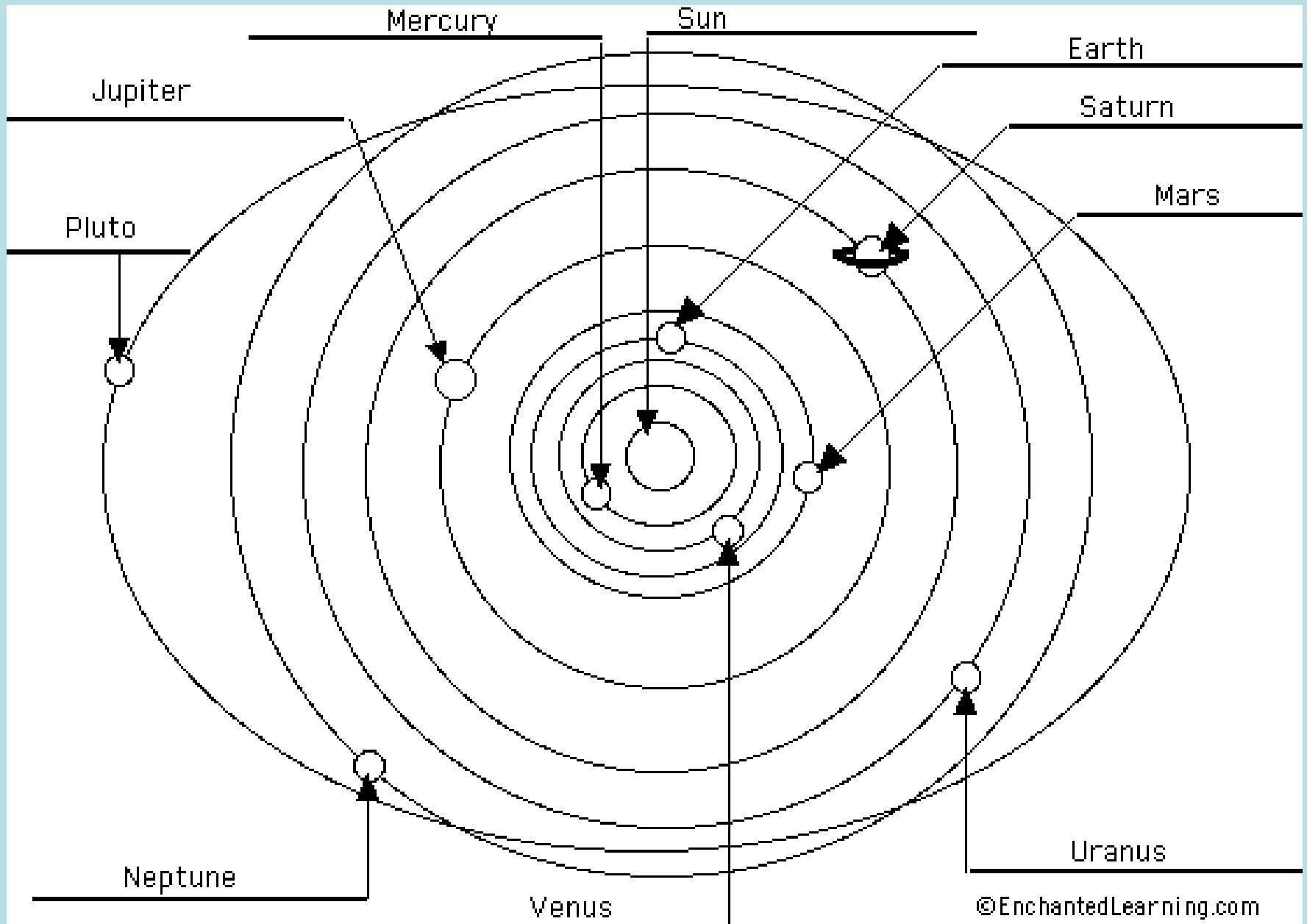
Solar system

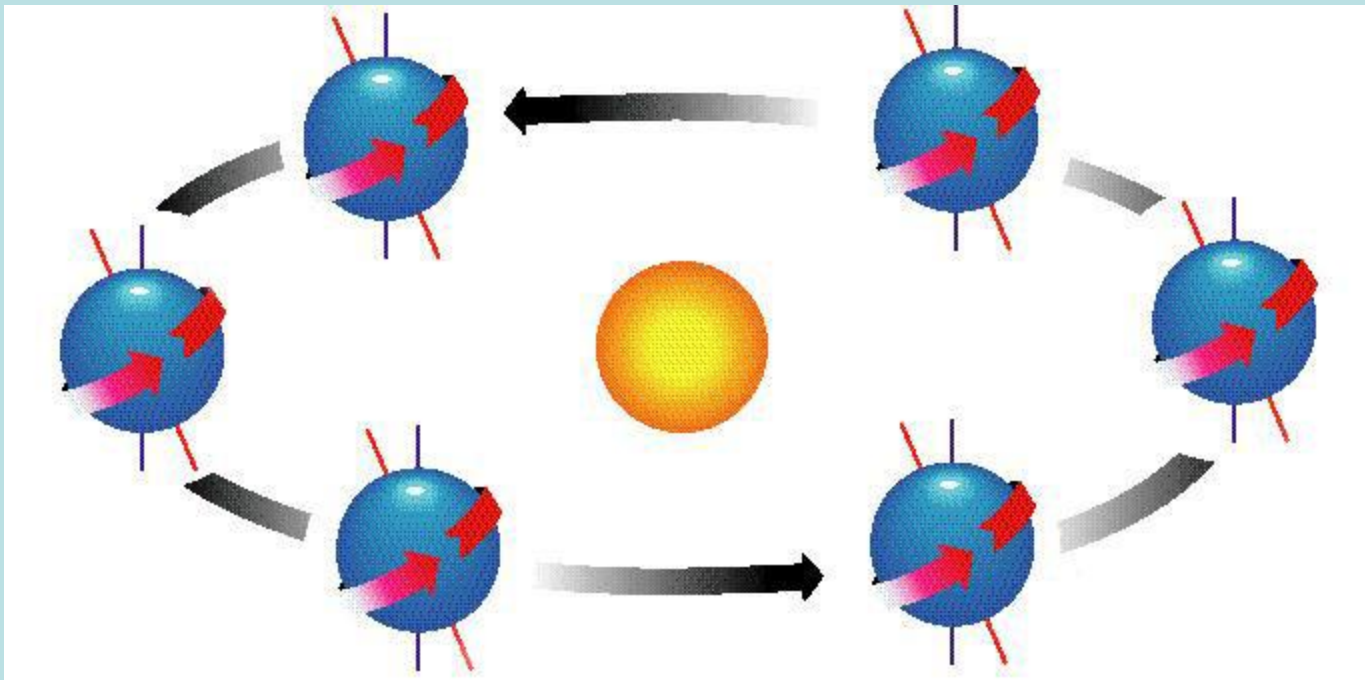


Dist. By www.LearningByGrace.org

http://www.thejubileeacademy.org/marketing/media/solar_system1.jpg

Label the Solar System

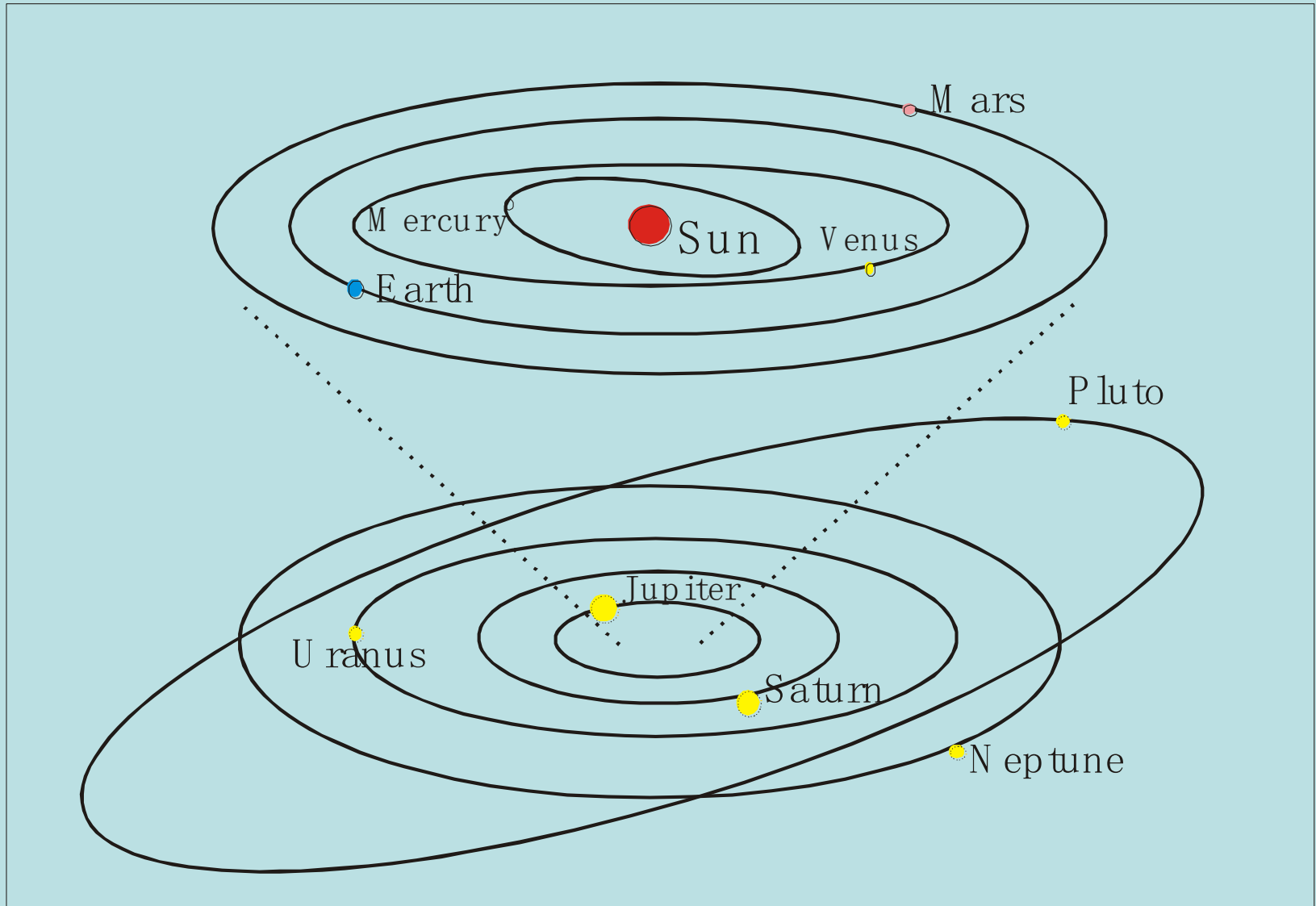




The Earth's Orbit

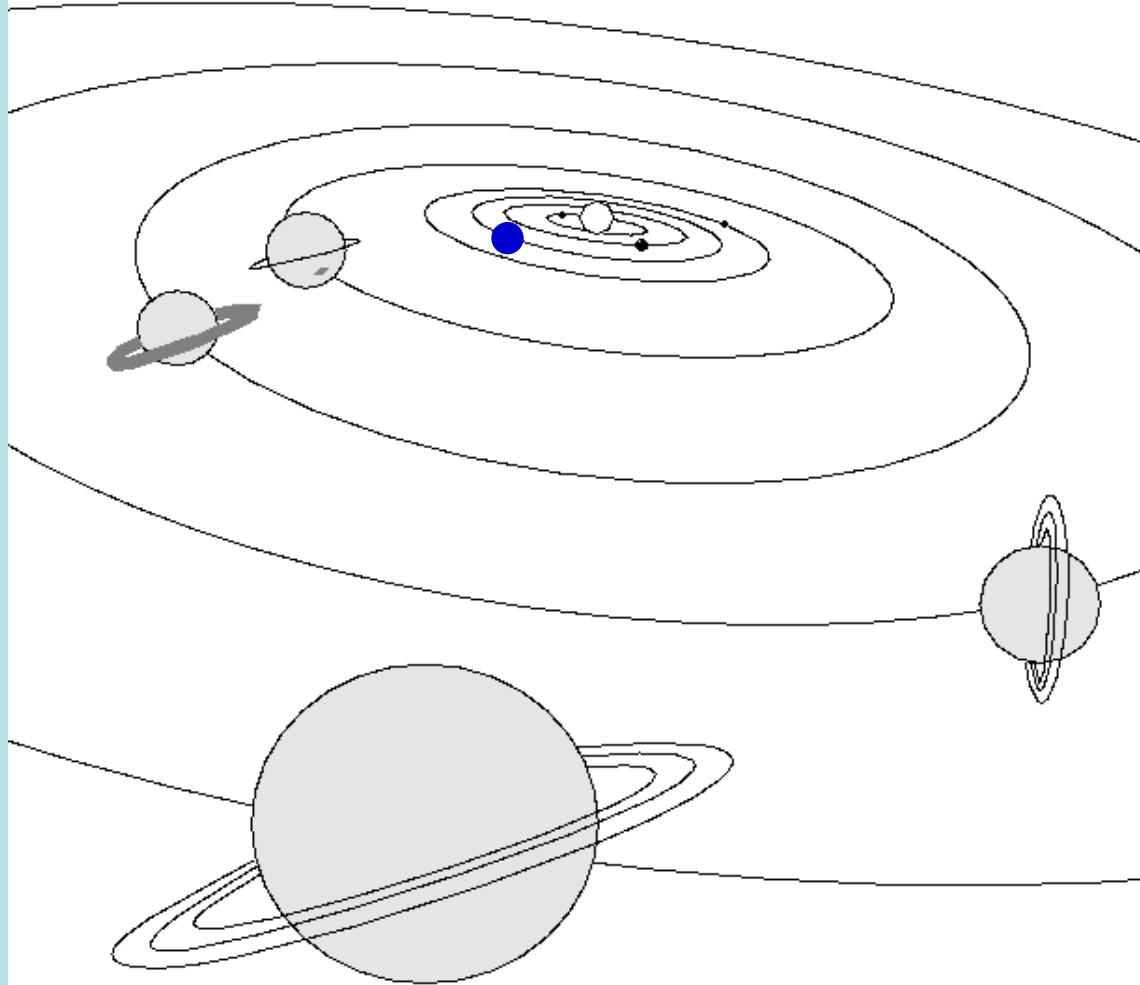
<http://www.dkimages.com/discover/previews/923/65030622.JPG>

Fig. 2.1 A scheme showing the relative orbits of the eight planets and Pluto in the solar system



The Plane of the Ecliptic

黄道面示意图

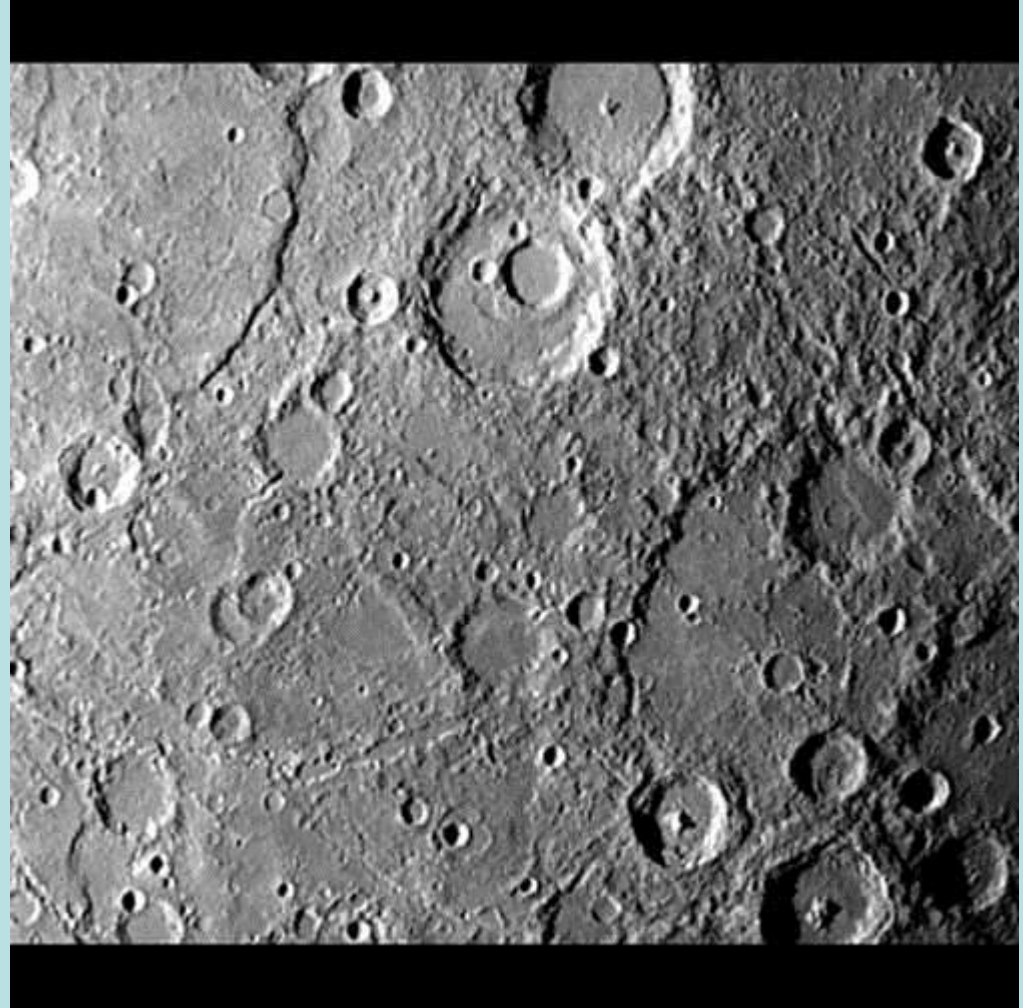
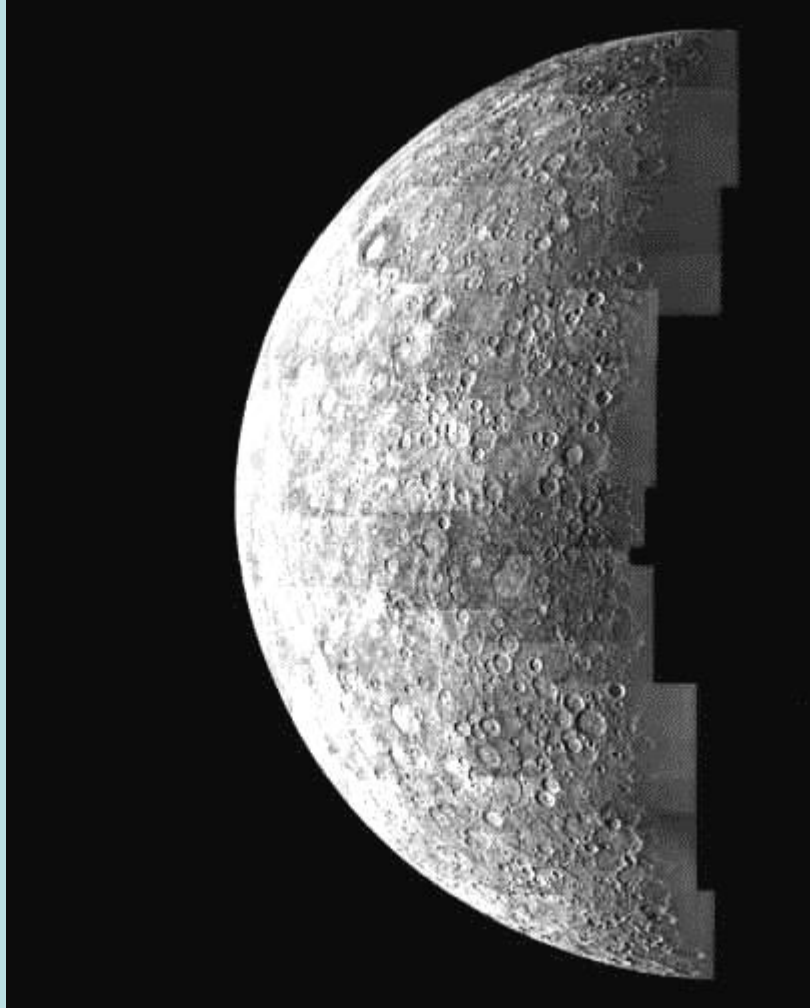


* Not to scale *

FIG. 1

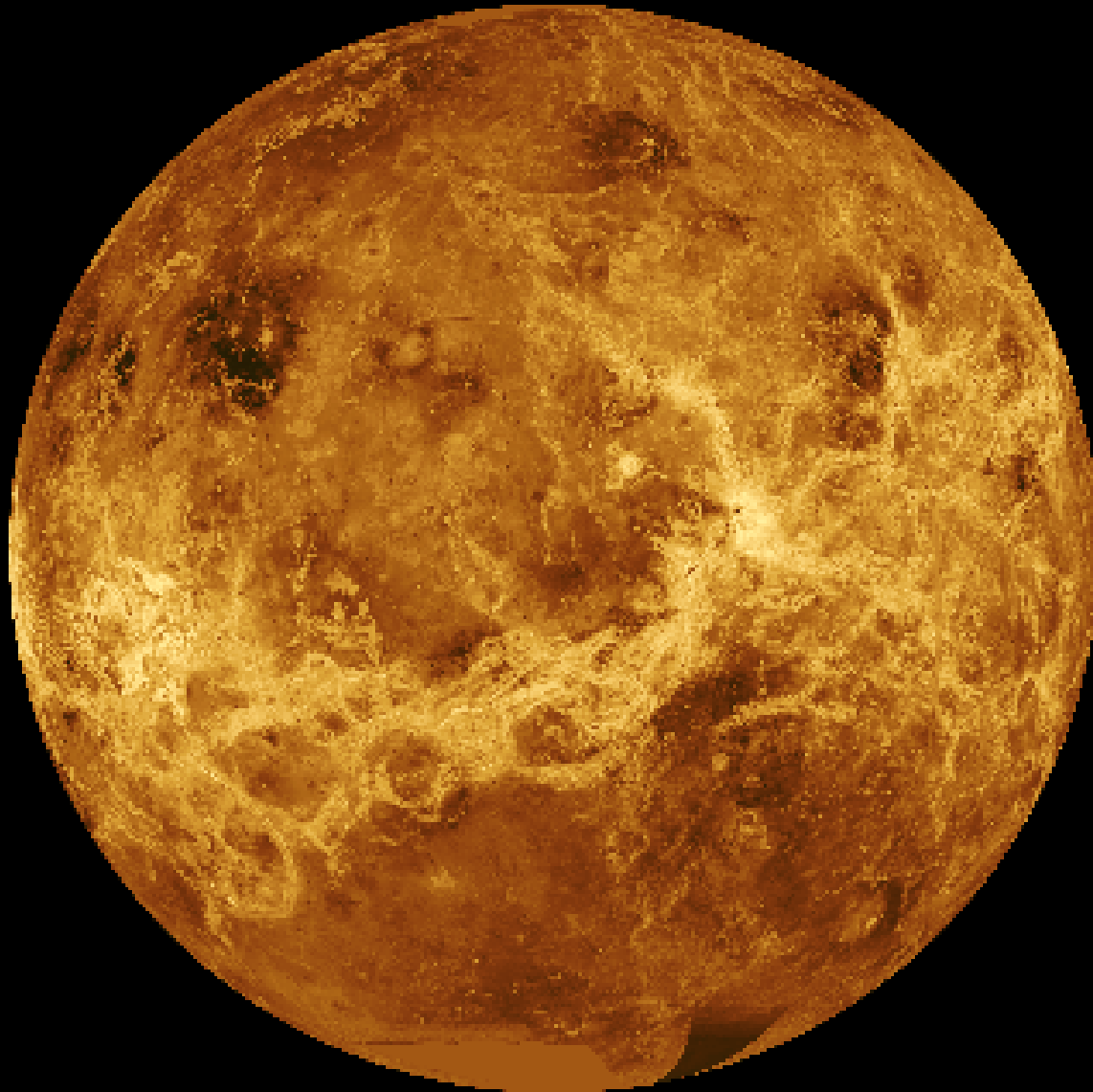
<http://cse.ssl.berkeley.edu/img/eclip.gif>

Mercury and its cratered terrain



<http://www.spaceimages.com/mercuryphotos.html>

Global view of Venus



http://us.st12.yimg.com/us.st.yimg.com/l/spaceimages_2042_51660564

Earth image from the space





**Earth and Moon
from the Galileo
spacecraft flight**



Hurricane Ivan regional imagery



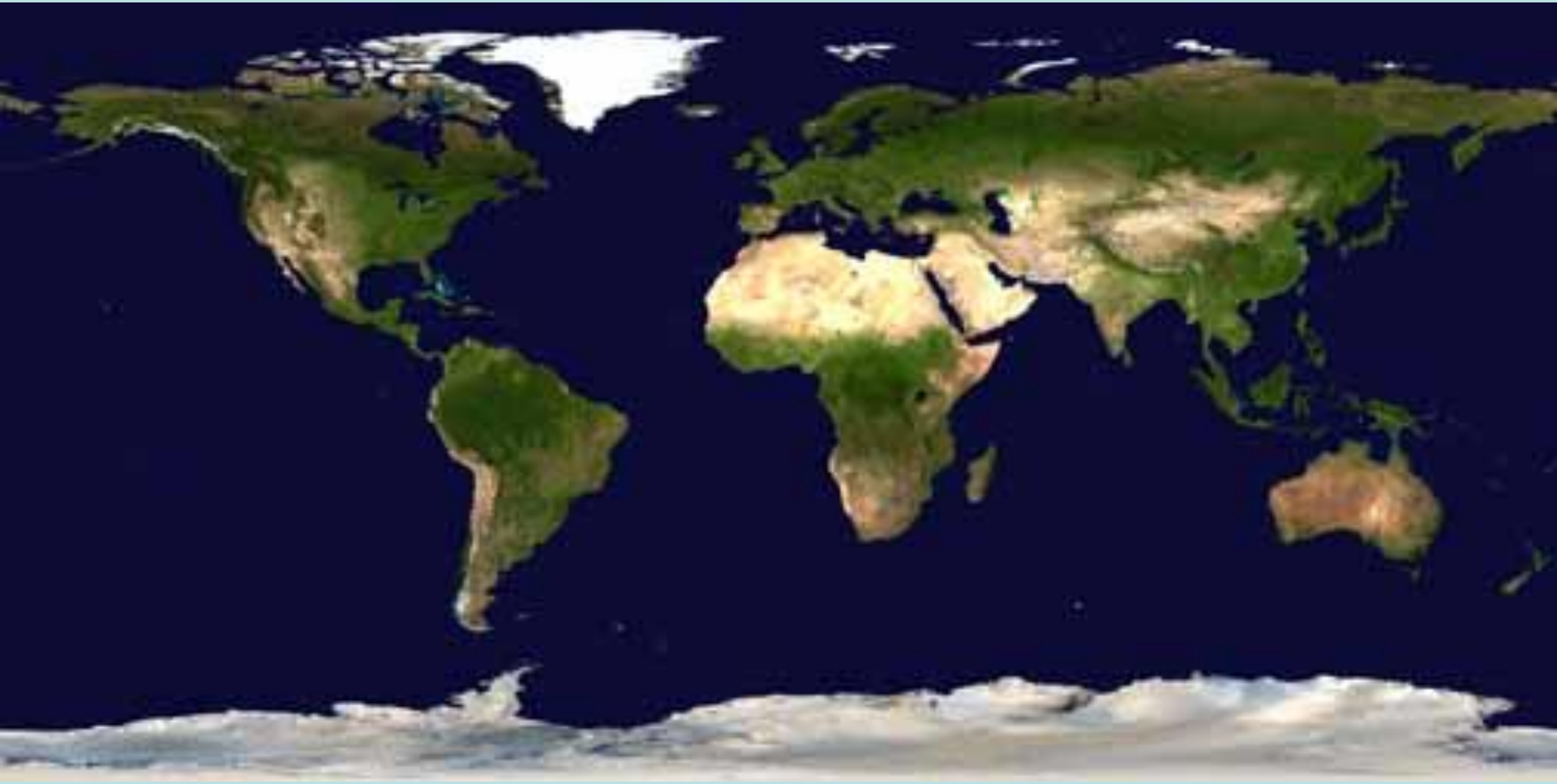
http://us.st12.yimg.com/us.st.yimg.com/l/spaceimages_2042_27426474

Image of North America at night



http://us.st12.yimg.com/us.st.yimg.com/l/spaceimages_2042_25880727

True-color image of the entire Earth



http://us.st12.yimg.com/us.st.yimg.com/l/spaceimages_2042_52703686

Mars through Hubble Telescope



http://us.st12.yimg.com/us.st.yimg.com/l/spaceimages_2042_45940623

Mars land surface



Jupiter



Saturn hanging in the blackness



Fig. 2.3 The elegant image of the planet Saturn with its rings
(www.solarviews.com)



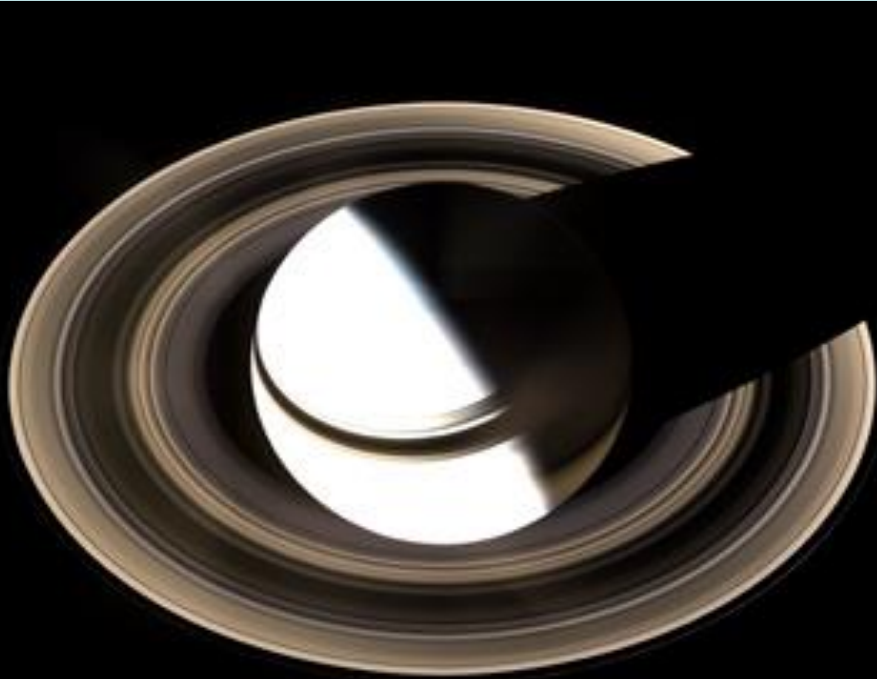
SATURN & its MOONS



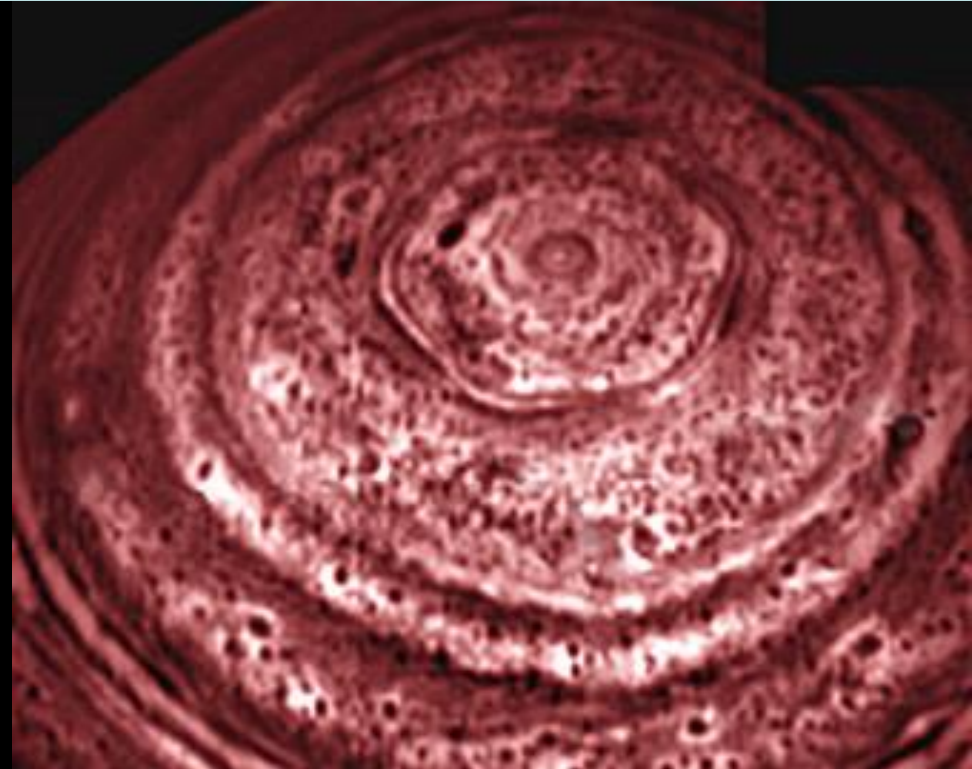
<http://www.fotosearch.com/DGV075/218828/>

Saturn images

Saturn's shadow



North pole of Saturn

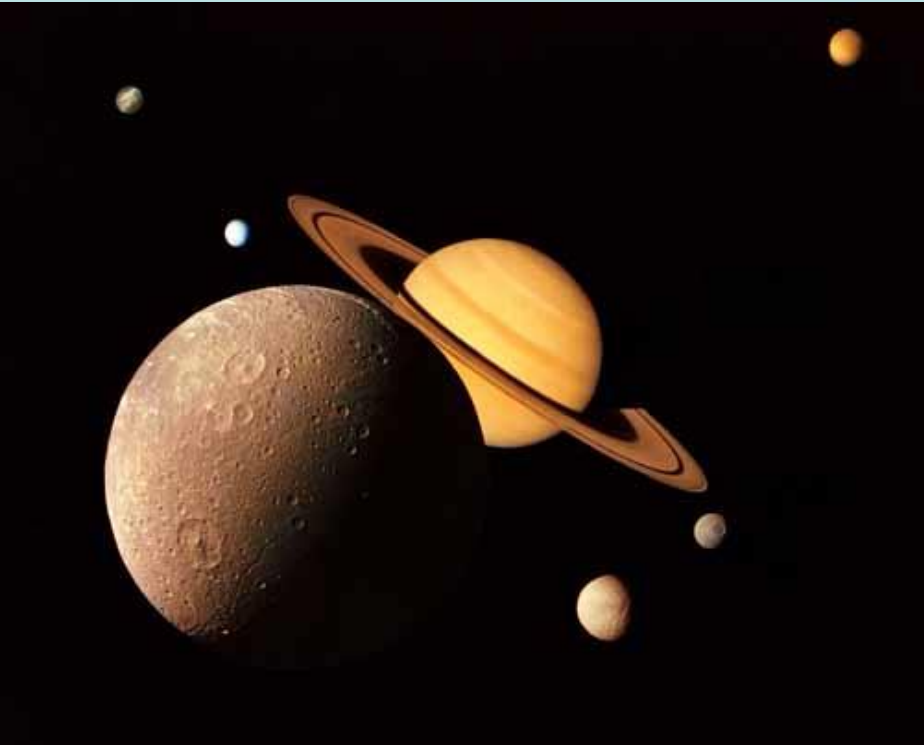


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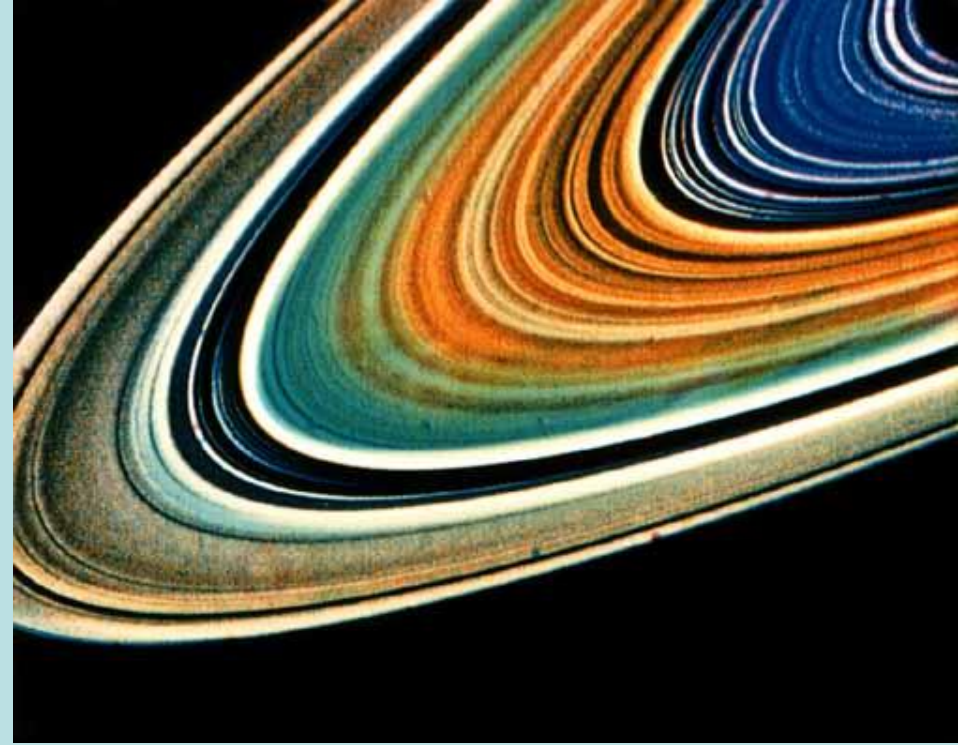
Saturn images

Montage of images
of the Saturn



http://us.st12.yimg.com/us.st.yimg.com/l/spaceimages_2042_506760

Part of Saturn's ring system

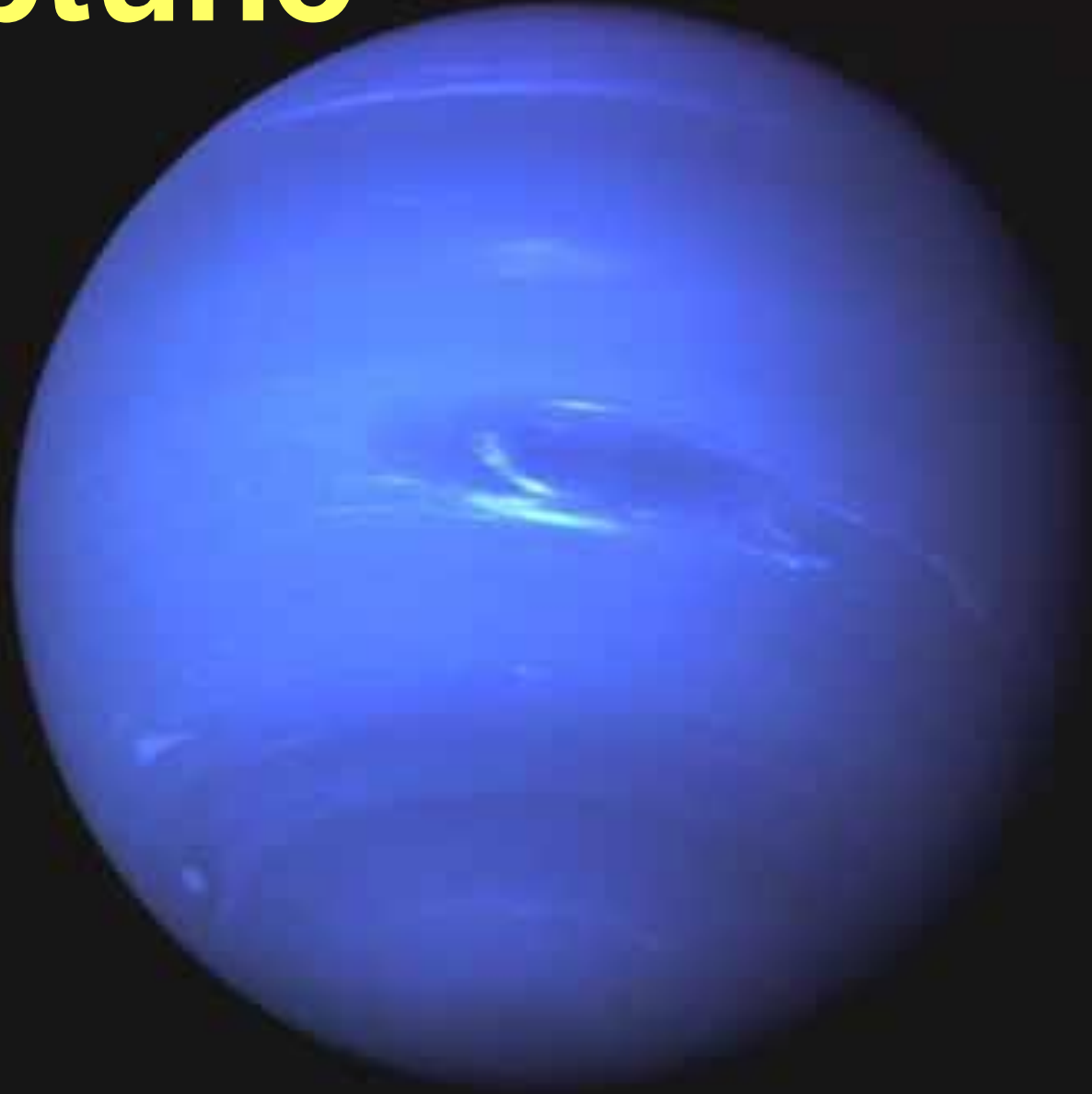


http://us.st12.yimg.com/us.st.yimg.com/l/spaceimages_2042_125807

Clouds on Uranus



Neptune



Additional reading (附加阅读) :

Pluto has been officially demoted from its status as a planet. The International Astronomical Union (IAU), at a meeting in August 2006, voted on their first "official" definition of a planet. Based on this new definition, Pluto is no longer a planet. According to the IAU's definition, our Solar System has eight planets: Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, and Neptune. In the new scheme, Pluto will be one of several "dwarf planets" in the Solar System; but "dwarf planets" are not considered true planets.

The controversy over Pluto's status as a planet has been brewing for years. Astronomers have long hypothesized the existence of a large class of icy objects, called **Kuiper Belt Objects** (KBOs), on the fringes of our Solar System. The first KBO was discovered in the early 1990s. Scientists recognized that Pluto, which was discovered in 1930, was really "just" one of many KBOs. In terms of its composition and its orbit, Pluto is unlike the other eight planets; but is quite similar to other objects in the Kuiper Belt.

There is still some controversy and disagreement amongst astronomers about the new definition of a "planet". We will have to wait and see whether the new definition "sticks" or not. For now, there are three official classes of objects in our Solar System: planets, dwarf planets, and small solar system bodies. Planets include the eight traditional planets from Mercury to Neptune, but no longer Pluto. Pluto is joined amongst the dwarf planets by [2003 UB313](#) and the large asteroid Ceres (谷神星) .

(Cereal:谷物)

<http://www.windows.ucar.edu> (Aug. 24, 2006)

The planets (行星)

Table 2.1 The nine planets in the order of increasing distance from the Sun

| Name | Some explanations | Characteristics |
|--|--|--|
| Mercury 水星 Venus 金星 Earth 地球 Mars 火星 | Innermost planet Named after goddess of Love and Beauty Our planet The red planet | Inner, small, dense (>3.9), rocky, with moons no more than 2, slow rotation and fast revolution. |
| (Asteroids)小行星带 | | |
| Jupiter 木星 Saturn 土星 Uranus 天王星 Neptune 海王星 Pluto 冥王星 | The lord of the heavens The elegant planet The twins Planet X (special one) | Larger, less dense, with more than 2 moons and thick atmosphere. Demoted from... |

Table 2.2 Some statistics of the planets in the solar system (Organized according to the data collected from <http://www.solarviews.com> by the end of 2003)

| Planets | Mercury | Venus | Earth | Mars | Jupiter | Saturn | Uranus | Neptune | Pluto |
|------------------------|--------------------------------|------------------------------|----------------------------------|------------------------------|--|--|---|---|------------------------------|
| Mass (kg) (Earth=1) | 3.303 e ²³ 0.055 | 4.87e ²⁴ 0.815 | 5.976e ²⁴ 1(Earth) | 6.42e ²³ 0.107 | 1.90e ²⁷ 3.18 e ² | 5.69e ²⁶ 9.52 e ¹ | 8.68 e ²⁵ 1.45 e ¹ | 1.02 e ²⁶ 1.71 e ¹ | 1.27e ²² 0.002 |
| Equatorial radius (km) | 2,439.7 | 6051.8 | 6378.14 | 3397.2 | 71,492 | 60,268 | 25,559 | 24,746 | 1,137 |
| Density | 5.42 | 5.25 | 5.515 | 3.94 | 1.33 | 0.69 | 1.29 | 1.64 | 2.05 |
| Rotational period | 58.646D Earth day | -243 | 0.997 23.93H | 1.026 | 0.413 | 0.426 | -0.748 | 0.673 | -6.38 |
| Orbit inclination | 7.004 | 3.394 | 0.000 | 1.850 | 1.308 | 2.488 | 0.774 | 1.774 | 17.15° |
| Distance of orbit (km) | 5.79e ⁷ 0.387 | 1.08 e ⁸ 0.720 | 1.50 e ⁸ 1(AU) | 2.28 e ⁸ 1.524 | 7.78 e ⁸ 5.203 | 1.43 e ⁹ 9.540 | 2.87 e ⁹ 19.218 | 4.50 e ⁹ 30.060 | 5.91 e ⁹ 39.53 |
| Orbit Period | 87.969 Days | 224.70 Days | 365.256 Days | 686.98 Days | 11.86 Years | 29.46 Years | 84.01 Years | 164.79 Years | 248.54 Years |
| Orbit velocity | ? | 35.02 km/s | 29.79 km/s | 24.13 km/s | 13.07 km/s | 9.67 km/s | 6.81 km/s | 5.45 km/s | 4.74 km/s |
| Orbit eccentricity | 0.2056 | 0.0068 | 0.0167 | 0.0934 | 0.0483 | 0.056 | 0.046 | 0.010 | 0.248 |
| Tilt of axis | 0° | 177.36 | 23.45° | 25.19 | 3.13 | 25.33 | 97.86 | 28.31 | 122.53 |
| Surface (T° C) | 179 | 482 | 15 | -63 | -121 | -125 | -193 | -193~ -153 | |
| Number of moons | 0 ? | 0 | 1 | 2 | > 16 | > 18 | > 27 | > 13 | 1 ? |

Classification of planets 行星的分类:

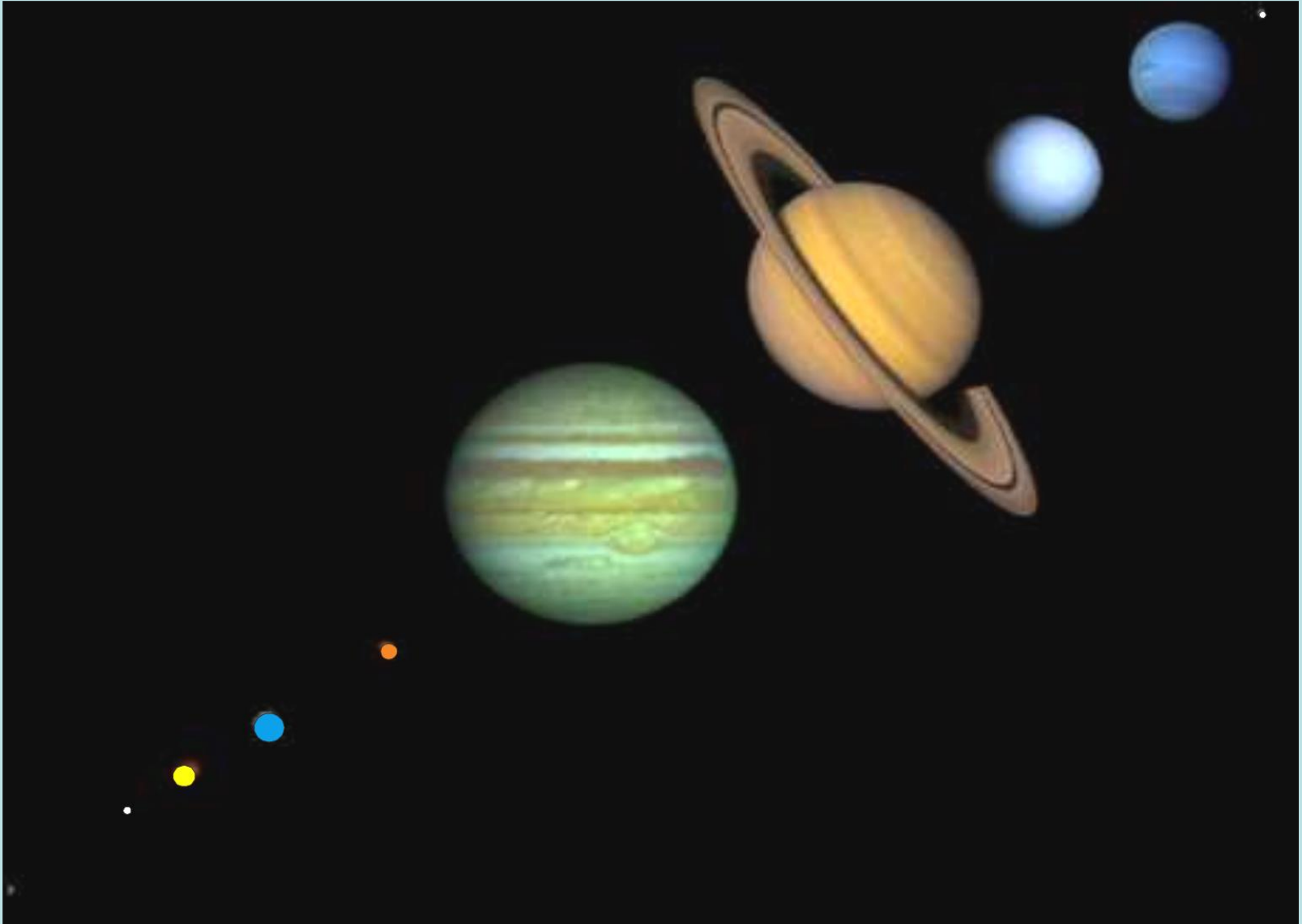
Terrestrial planets (类地行星) : Mercury, Venus, Earth and Mars. The word “Terra” means the Earth in Latin word.

Jovian planets (类木行星) : Jupiter, Saturn, Uranus and Neptune (the twins). Their names come from Jove—an alternate designation for the Roman God Jupiter. **Pluto is special.**

Between the **Jovian** and the **Terrestrial** planets there are a lot of **asteroids** (小行星)

In the order of volume (from larger to smaller):

Jupiter, Saturn, Uranus, Neptune, Earth, Venus, Mars, Mercury and Pluto (木星、土星、天王星、海王星、地球、金星、火星、水星、冥王星)。



Satellite (卫星) (moon月亮):

Lowland—Maria (月海), which is covered with **mare basalt** (月海玄武岩). The word Mara (the plural form is Maria) is a Latin word, another form of Mary, goddess.

Highland—lunar continent (月陆) (intense cratering).

regolith (月壤)—the blanket of loose, noncemented rock particles (dust) that cover the surface of the Moon.



LCROSS Impact Data Indicates Water on Moon

The argument that the moon is a dry, desolate place no longer holds water.

Secrets the moon has been holding, for perhaps billions of years, are now being revealed **to the delight of** scientists and space enthusiasts alike.

NASA today opened a new chapter in our understanding of the moon.

Preliminary data from the **Lunar Crater Observation and Sensing Satellite**, or LCROSS, indicates that the mission successfully uncovered water during the **Oct. 9, 2009** impacts into the permanently shadowed region of Cabeus crater near the moon's south pole.

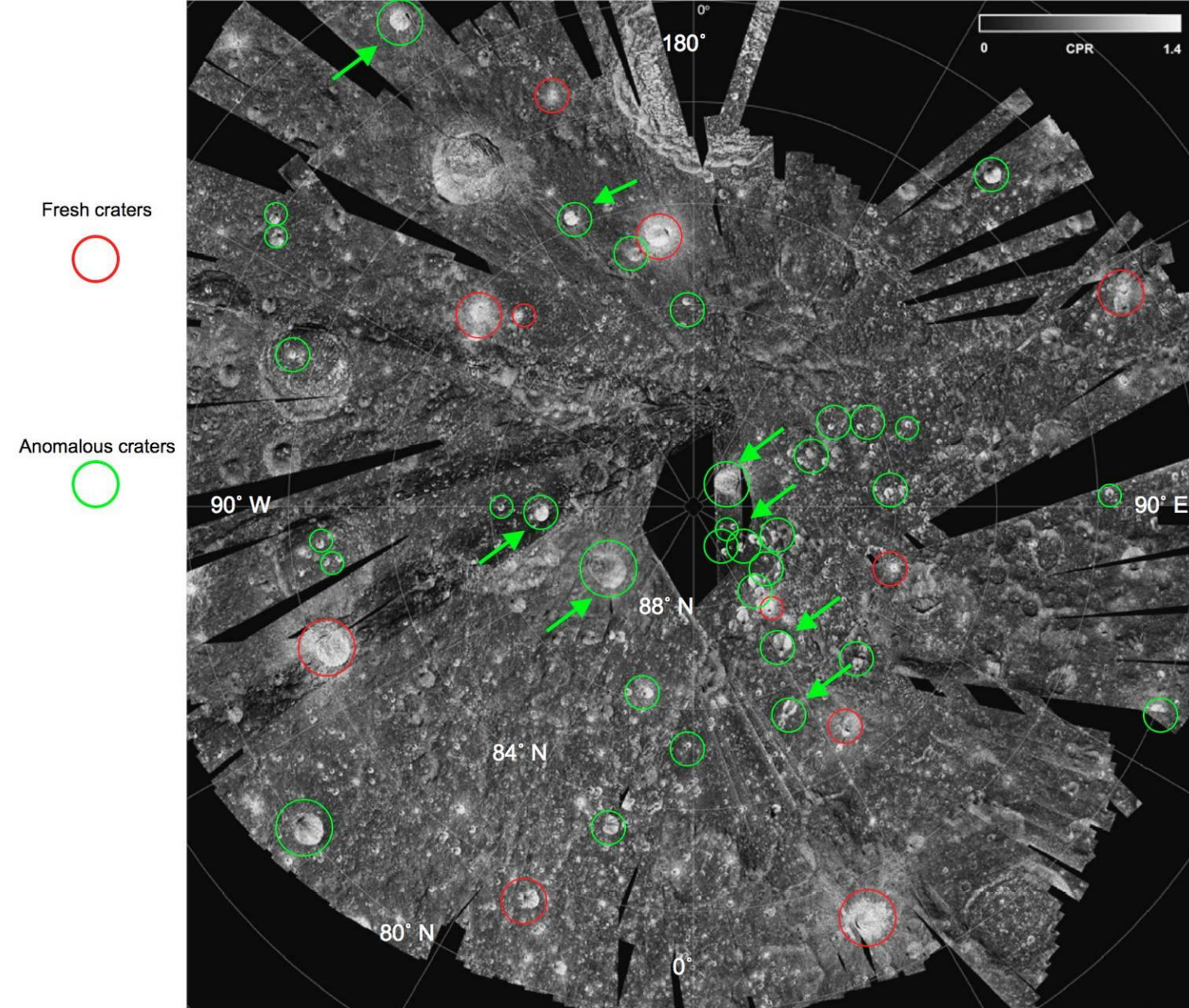
The impact created by the LCROSS Centaur (半人马怪物) upper stage rocket created a two-part plume of material from the bottom of the crater. The first part was a high angle plume of vapor and fine dust and the second a lower angle **ejecta curtain** of heavier material. This material has not seen sunlight in billions of years.

"We're unlocking the mysteries of our nearest neighbor and **by extension** (甚至) the solar system. It **turns out** the moon harbors many secrets, and LCROSS has added a new layer to our understanding," said Michael Wargo, chief lunar scientist at NASA Headquarters in Washington.

NASA--National Aeronautics and Space Administration美国航空航天局

LCROSS—Lunar Crater Observation and Sensing Satellite月球环形山观测卫星

http://www.nasa.gov/mission_pages/LCROSS/main/prelim_water_results.html

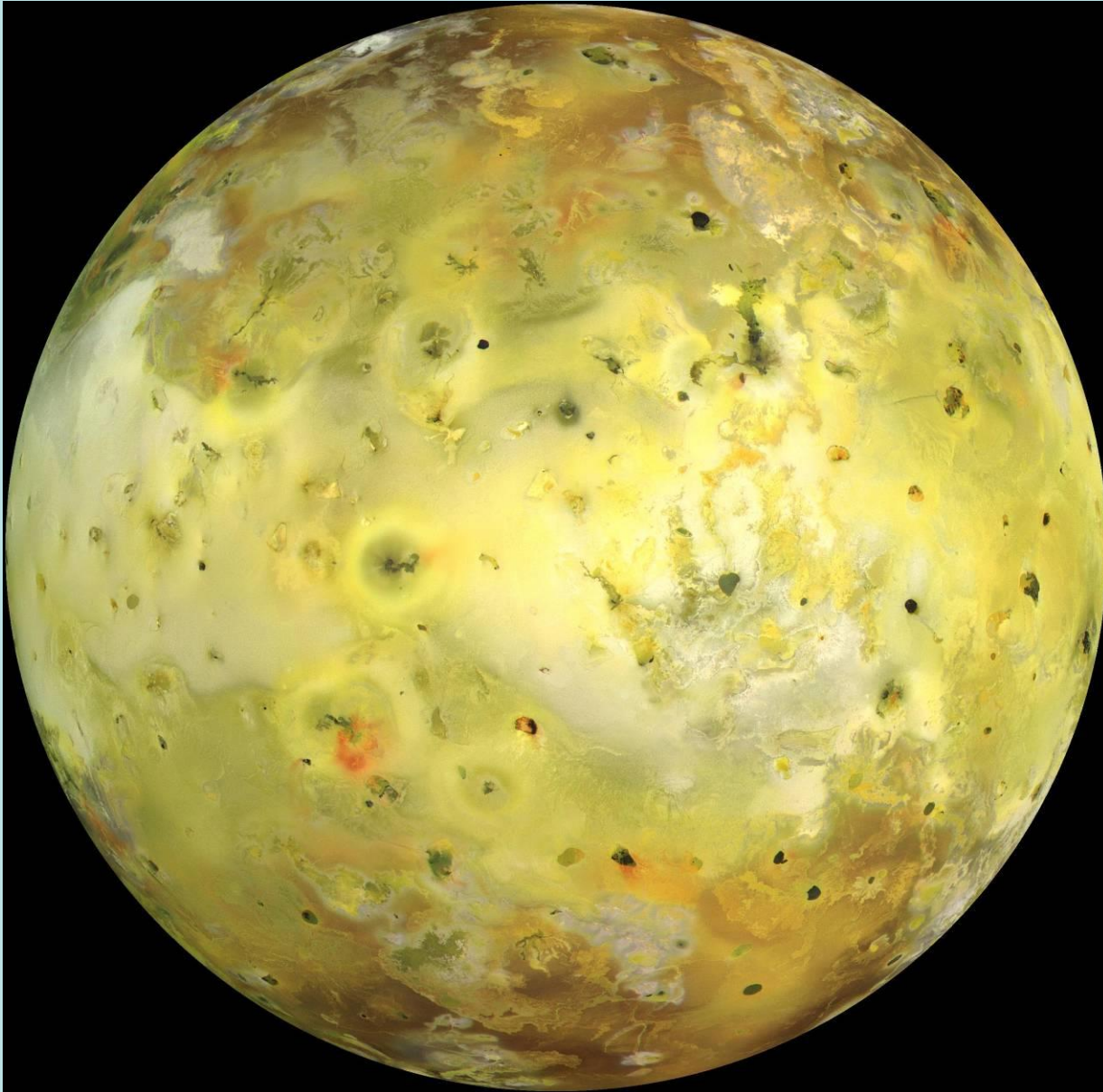


NASA Radar Finds Ice Deposits at Moon's North Pole----
Additional evidence of water activity on moon

http://www.nasa.gov/mission_pages/Mini-RF/multimedia/feature_ice_like_deposits.html

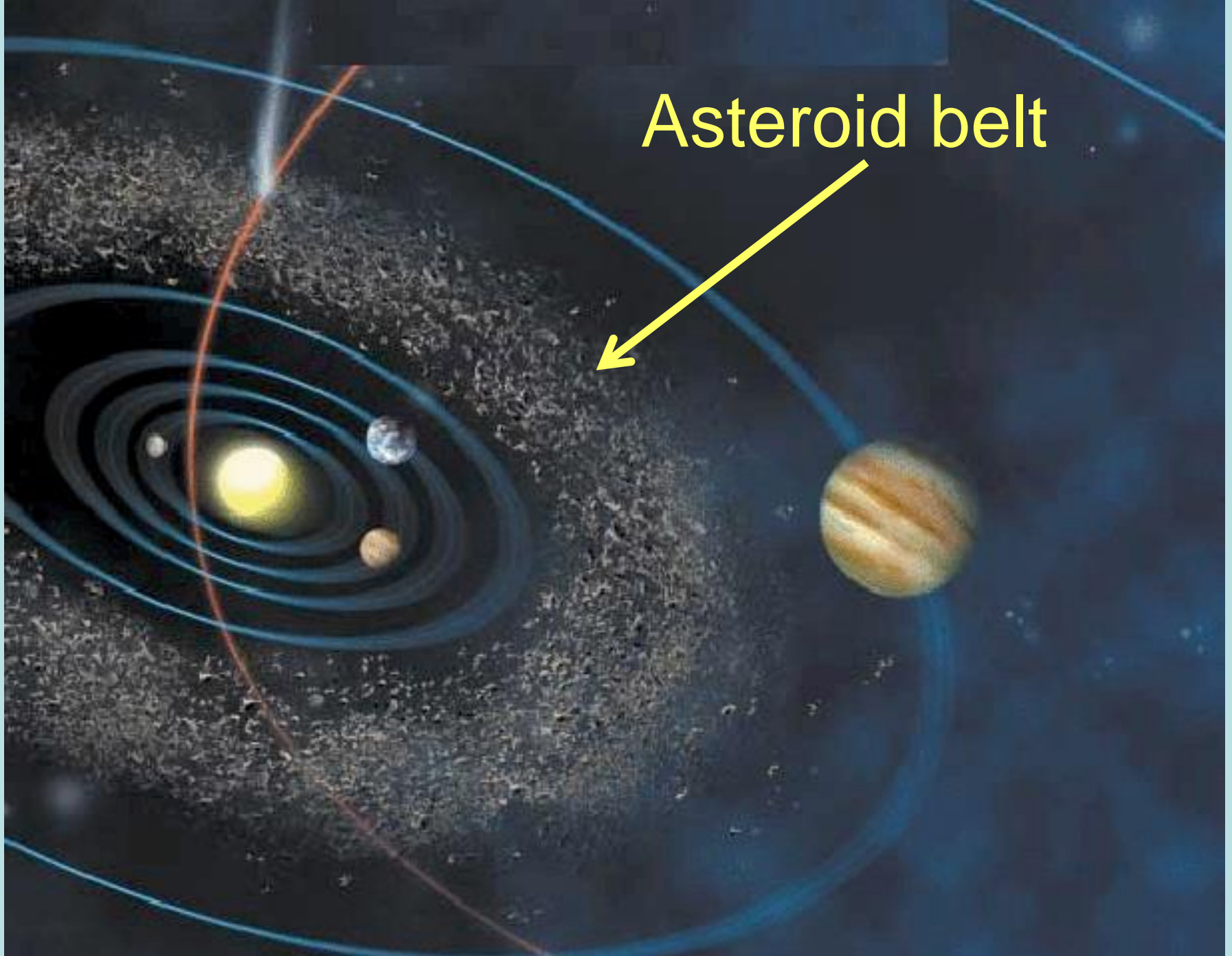
Io is the innermost of the four Galilean moons of Jupiter and, with a diameter of 3,642 kilometers, the fourth-largest moon in the Solar System.

Io



http://en.wikipedia.org/wiki/File:Io_highest_resolution_true_color.jpg

Asteroid belt



Asteroids

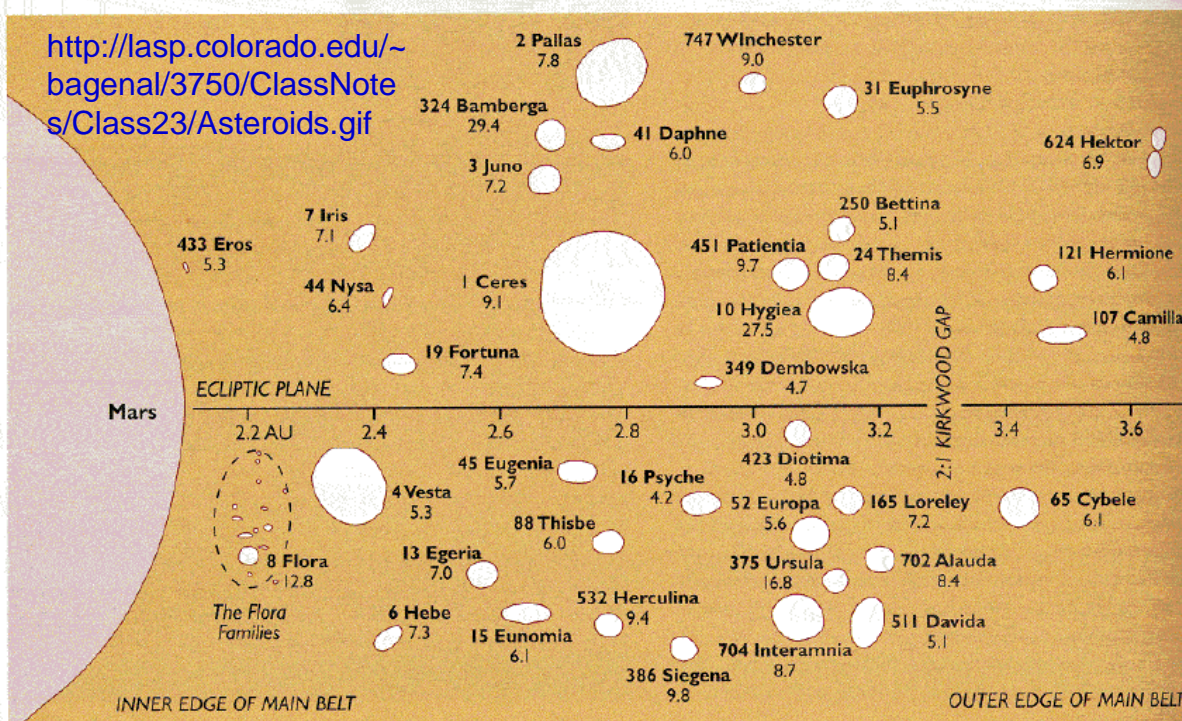
Image of Gaspra



http://www.windows.ucar.edu/tour/link=/asteroids/images/gaspracol_image.html



<http://lasp.colorado.edu/~bagenal/3750/ClassNotes/Class23/Asteroids.gif>



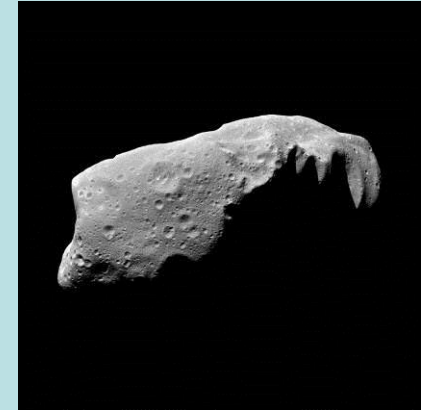
INNER EDGE OF MAIN BELT

OUTER EDGE OF MAIN BELT

Asteroids (小行星)



<http://www.mtholyoke.edu>

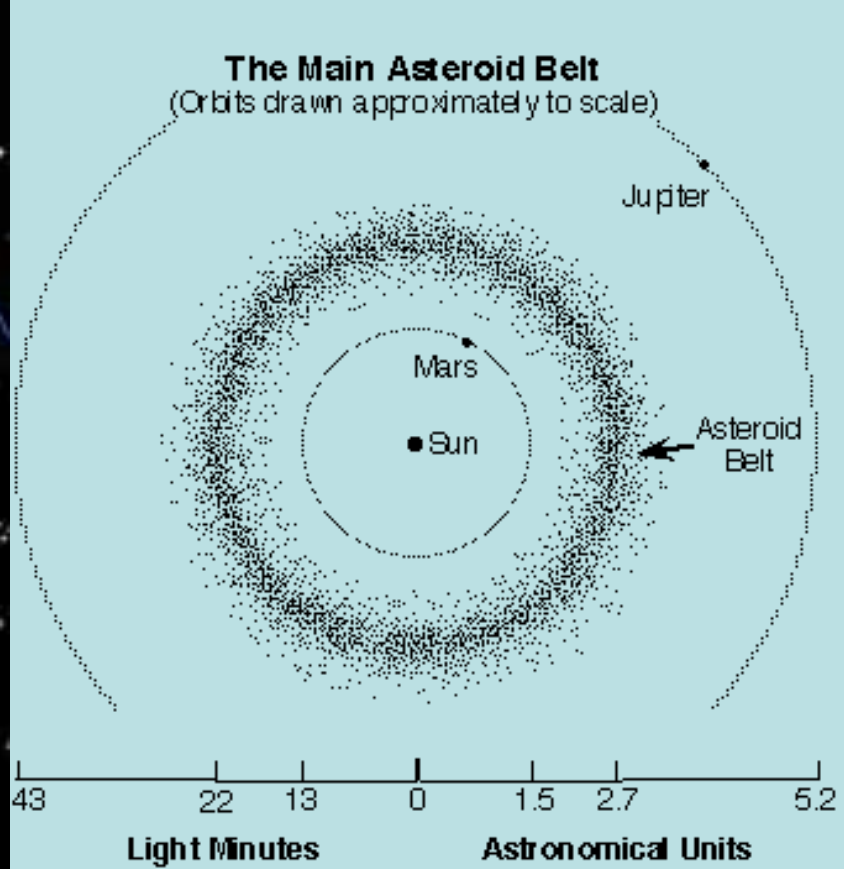


<http://neo.jpl.nasa.gov/images/ida.html>

Asteroids are rocky and metallic objects that orbit the Sun but are too small to be considered planets. They are known as *minor planets*. Asteroids range in size from Ceres (谷神星), which has a diameter of about 932 km, down to the size of pebbles. Sixteen asteroids have a diameter of 240 km or greater. They have been found inside Earth's orbit to beyond Saturn's orbit. Most, however, are contained within a *main belt* that exists between the orbits of Mars and Jupiter.



www.tqnyc.org/NYC063368/the_asteriod_belt.htm



<http://www.solarviews.com/eng/asteroid.htm>

The asteroid belt contains asteroids that circle around the Sun. Sometimes asteroids collide with each other and the asteroid might break up into smaller pieces. Asteroids can be from a few feet to hundreds of miles wide. The asteroid belt has more than 40,000 asteroids that are half a mile long.

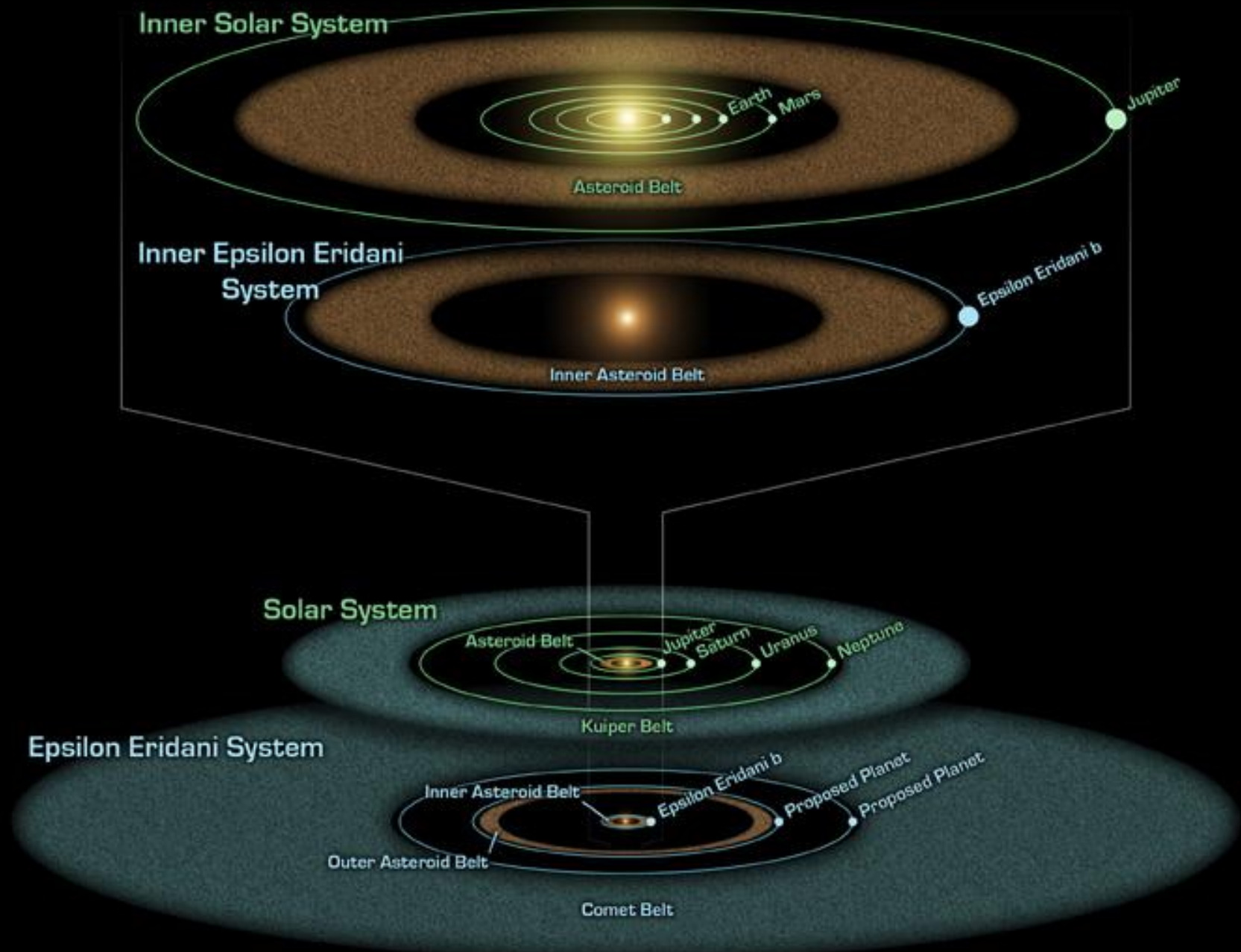
Asteroids (小行星) are material left over from the formation of the solar system. One theory suggests that they are the remains of a planet that was destroyed in a massive collision long ago. More likely, asteroids are material that never coalesced into a planet. In fact, if the estimated total mass of all asteroids was gathered into a single object, the object would be less than 1,500 kilometers (932 miles) across -- less than half the diameter of our Moon.

Much of our understanding about asteroids comes from examining pieces of space debris that fall to the surface of Earth. Asteroids that are on a collision course with Earth are called **meteoroids** (隕星). When a meteoroid strikes our atmosphere at high velocity, friction causes this chunk of space matter to **incinerate** (焚化) in a streak of light known as a **meteor** (流星). If the meteoroid does not burn up completely, what's left strikes Earth's surface and is called a **meteorite** (隕石). Of all the meteorites examined, 92.8 percent are composed of silicate (stone), and 5.7 percent are composed of iron and nickel; the rest are a mixture of the three materials. Stony meteorites are the hardest to identify since they look very much like terrestrial rocks.

Why are planets round whereas most asteroids are not?

Gravity. It pulls the various parts of the object toward the center. Gravity increases with mass. Extremely massive objects, like planets and the larger asteroids, have enough gravity that the object must assume a roughly spherical shape.

http://wiki.answers.com/Q/Why_are_planets_round_and_most_asteroids_are_not&src=ansTT



Comet

Tails get longer the closer a comet gets to the Sun.

Tails are always directed away from Sun. Gas (ion) tail points straight away from Sun. Dust tail curves toward orbital path.

Orbit of comet



Comet (彗星)



This image of the Hale-Bopp comet was taken by National Astronomical Observatory of Japan on March 7, 1997

http://www.windows.ucar.edu/tour/link=/headline_universe/space_science/Hale-Bopp_March7_image.html

Watching Comet Hale-Bopp

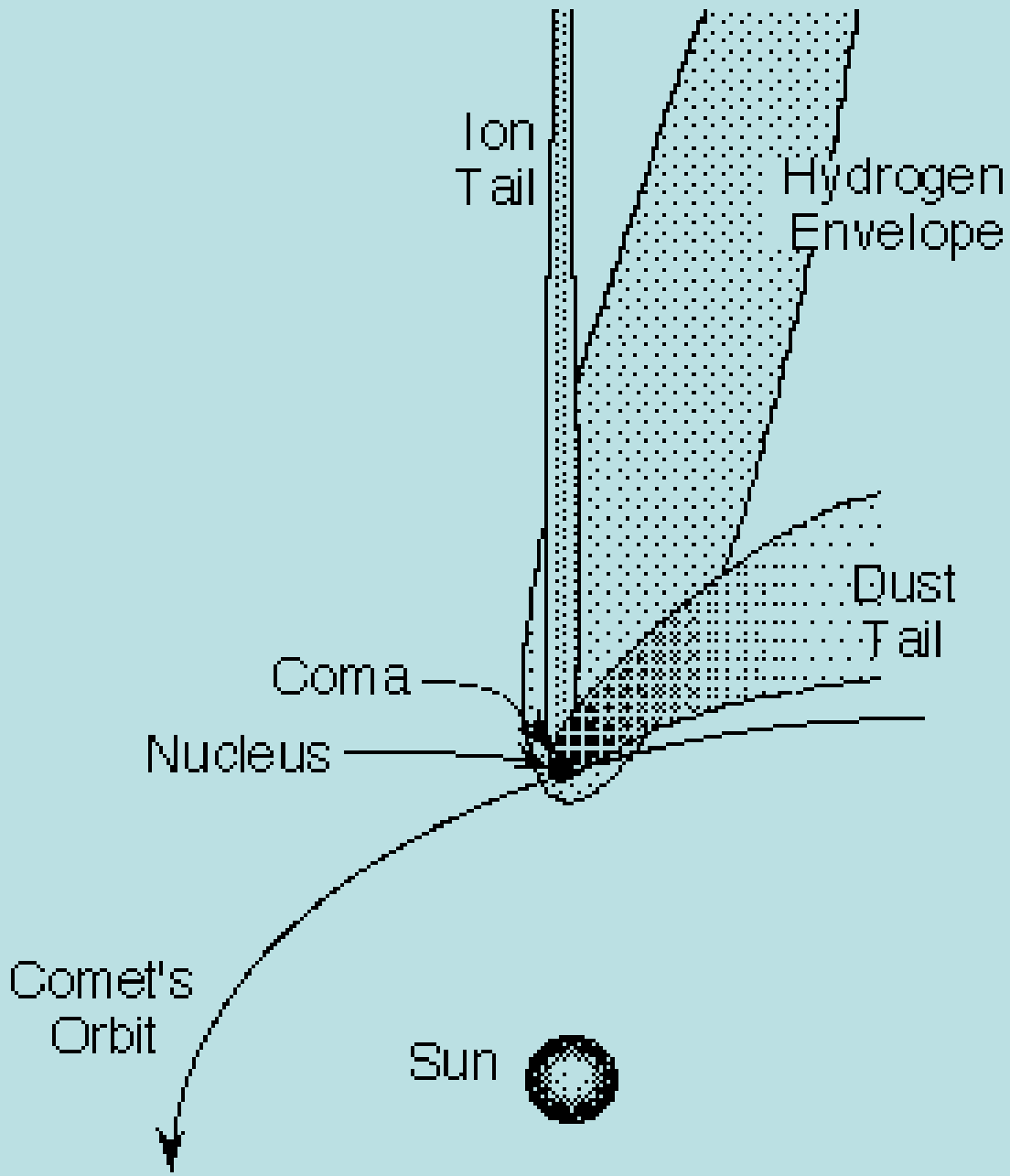


http://www.ifa.hawaii.edu/images/hale-bopp/hb_04april97.html



Components Of Comets

<http://www.solarviews.com/eng/comet.htm>



Comets are small, fragile, irregularly shaped bodies composed of a mixture of non-volatile grains and frozen gases. They have highly elliptical orbits that bring them very close to the Sun and swing them deeply into space, often beyond the orbit of Pluto.

As comets approach the Sun they develop enormous tails of luminous material that extend for millions of kilometers from the head, away from the Sun. When far from the Sun, the nucleus is very cold and its material is frozen solid within the nucleus. In this state comets are sometimes referred to as a "dirty iceberg" or "dirty snowball," since over half of their material is ice.

Meteorite impact



<http://www.darrenstraight.com/blog/images/2006/06/meteorite.jpg>

Million-dollar space rock unearthed, USA



http://msnbcmedia1.msn.com/j/msnbc/Components/Photos/051111/051111_meteorite_hmed_4p.widec.jpg



An impact crater formed by a small rock debris (Photo by Hongbo Lu, 2008)

Meteorite (隕星) and meteoroid (流星)

Stony meteorite (石隕石) -----92.8% of meteorites (the density is between 3 and 3.5)

Chondrites (球粒隕石) -----85.7% of meteorites

Achondrites (非球粒隕石) -----7.1% of meteorites

Iron meteorite (铁隕石) -----5.7%

Stony iron meteorite (石铁隕石) ---1.5%

Chondrites are the most common meteorites (the major stony chondrites).

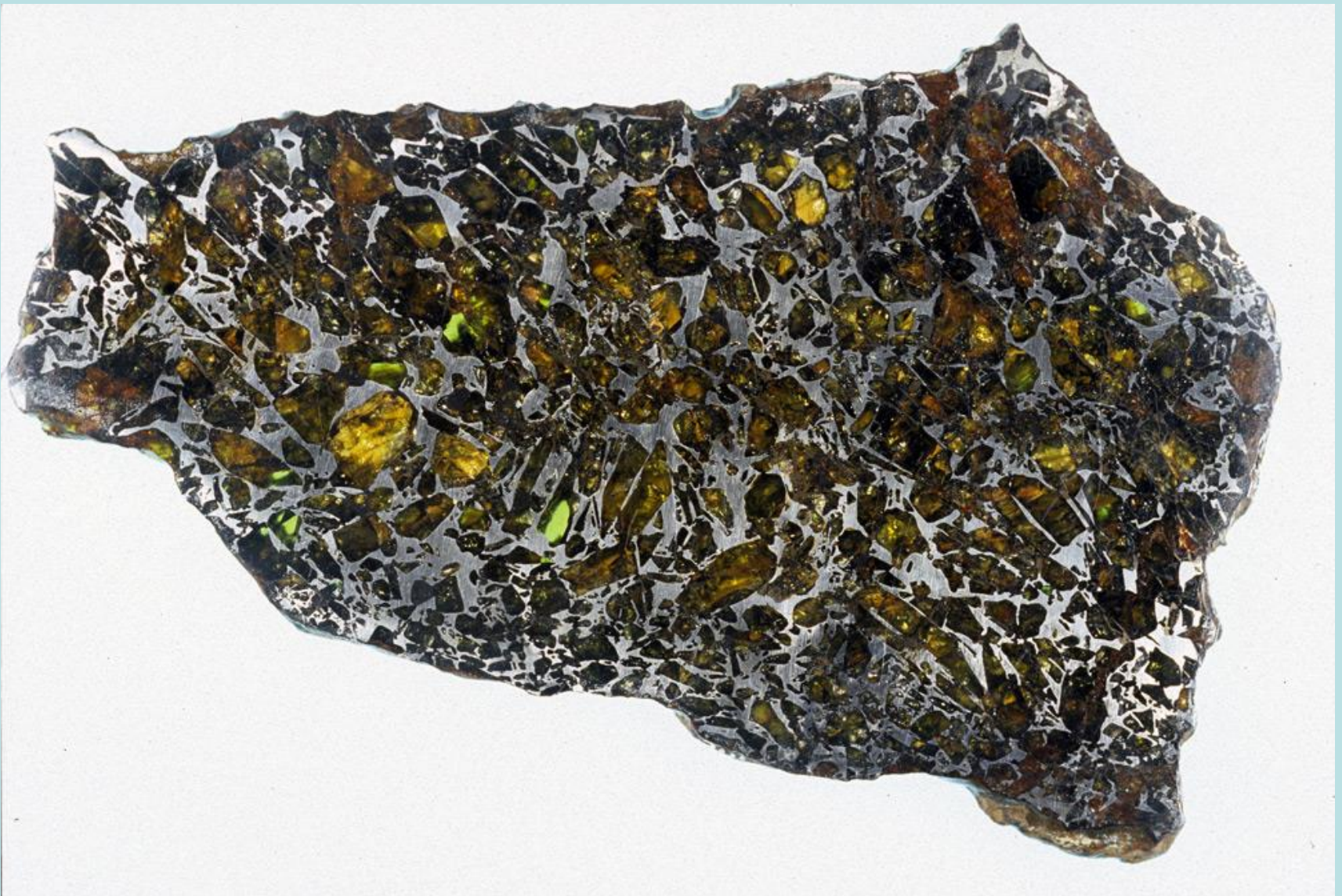
Radiometric dating of chondrites has placed them at the age of 4.55 billion years, which is the approximate age of the solar system. They are considered pristine (质朴的) samples of early solar system matter, although in many cases their properties have been modified by thermal metamorphism or icy alteration.

Achondrites are also stony meteorites, but they are considered differentiated or reprocessed matter. They are formed through melting and recrystallization (重结晶) on or within meteorite parent bodies. As a result, achondrites have distinct textures and minerals that indicate the igneous processes.

Meteorite shower (隕石雨) means a lot of meteorites falling to the surface of the Earth.

Meteorite crater (隕石坑) is made by the impact of meteorite.

Meteoroid (流星) is a small piece of matter in space (meteor流星) that travels around the Sun



a stony-iron meteorite, measures ~ 18 cm long. Albin was found in 1915 in Laramie County. Photo by D. Ball, ASU.

<http://meteorites.asu.edu/images/albin-big.jpg>



New Concord, OH, ordinary chondrite. This stony meteorite, which is ~ 17 cm from top to bottom, fell in Muskingum County on May 1, 1860.

Photo by D. Ball

<http://meteorites.asu.edu>



This iron meteorite was found in 1931. More than 2000 kg were collected. This specimen, which is on display in our museum, measures ~ 26 cm long. Photo by D. Ball

Meteorite (隕星) and meteoroid (流星)

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Interesting description

The planets in the solar system are different in size. The way to help visualize the relative sizes in the solar system is to imagine a model in which it is reduced in size by a factor of a billion. Then the Earth is about 1.3 cm in diameter (the size of a grape). The Moon orbits about a foot away. The Sun is 1.5 meters in diameter (about the height of a man) and 150 meters (about a city block) from the Earth. Jupiter is 15 cm in diameter (the size of a large grapefruit) and 5 blocks away from the Sun. Saturn (the size of an orange) is 10 blocks away; Uranus and Neptune (lemons) are 20 and 30 blocks away. A human on this scale is the size of an atom; the nearest star would be over 40,000 km away. Figure 2.2 shows the relative sizes of the nine planets in the solar system (Fig. 2.2).

2.3 Amazing regularities in the Solar System 太阳系中几条有趣的定律

2.3.1 Titius—Bode Rule:

Each planet is roughly twice (1.5~2 times) as far as the next inner one from the Sun. According to this rule, asteroids should come from a former planet. We can check this with the data listed in the table 2.2 (Table 2.2).

2.3.2 The law of Gravitation, found by Newton (1643—1727)

$$F = \frac{Gm_1m_2}{r^2}$$

In which, F—gravitation force (万有引力) ;
G—gravitation constant (万有引力常数) ;
 m_1 , m_2 —the mass of two objects (两个物体的质量) ;
r—distance between 2 objects (两物体之间距离) .

2.3.3 Three movement laws of planets 行星运动三定律

The laws were found by **Kepler** (1570—1630), who found that the planets' orbits were elliptical.

A. First law:

$$E = \frac{c}{a} = \frac{\sqrt{a^2 - b^2}}{a}$$

In which:

- e—ellipticity (椭圆率) ;
- a—long radius (长轴半径) ;
- b—short radius (短轴半径) ;
- c—half focal distance (半焦距) .

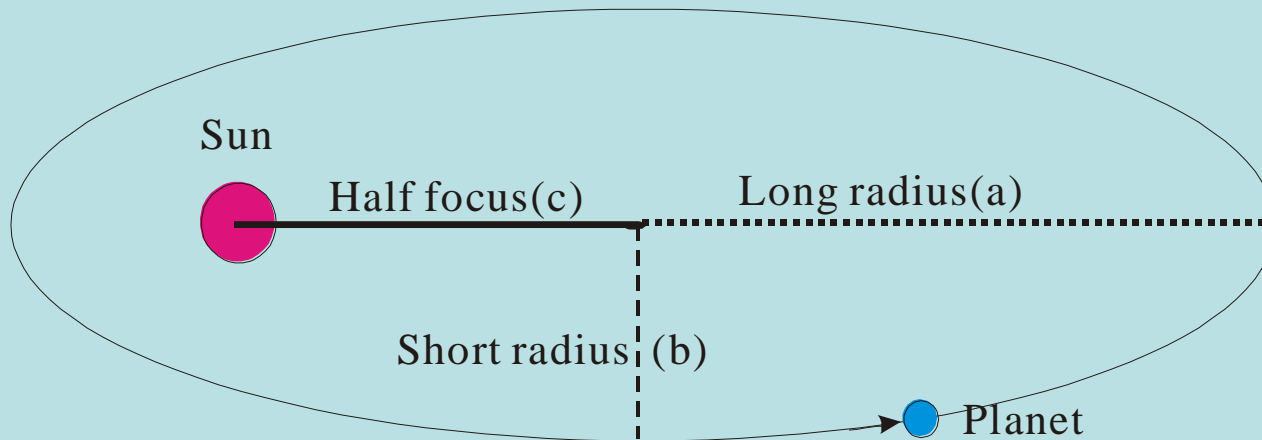


Fig. 2.6 A sketch diagram showing Kepler's First Law.

B. Second law: The orbiting radius of a planet passed the same area within the same period of time (Fig. 2.7). This is the conservation of angular momentum (角动量守恒) .

行星向径在单位时间里扫过的面积相等，因此在近日点就快而在远日点就慢

$$c = m v r$$

in which **m**—mass; **v**—velocity; **r**—orbiting radius; **c**—constant.

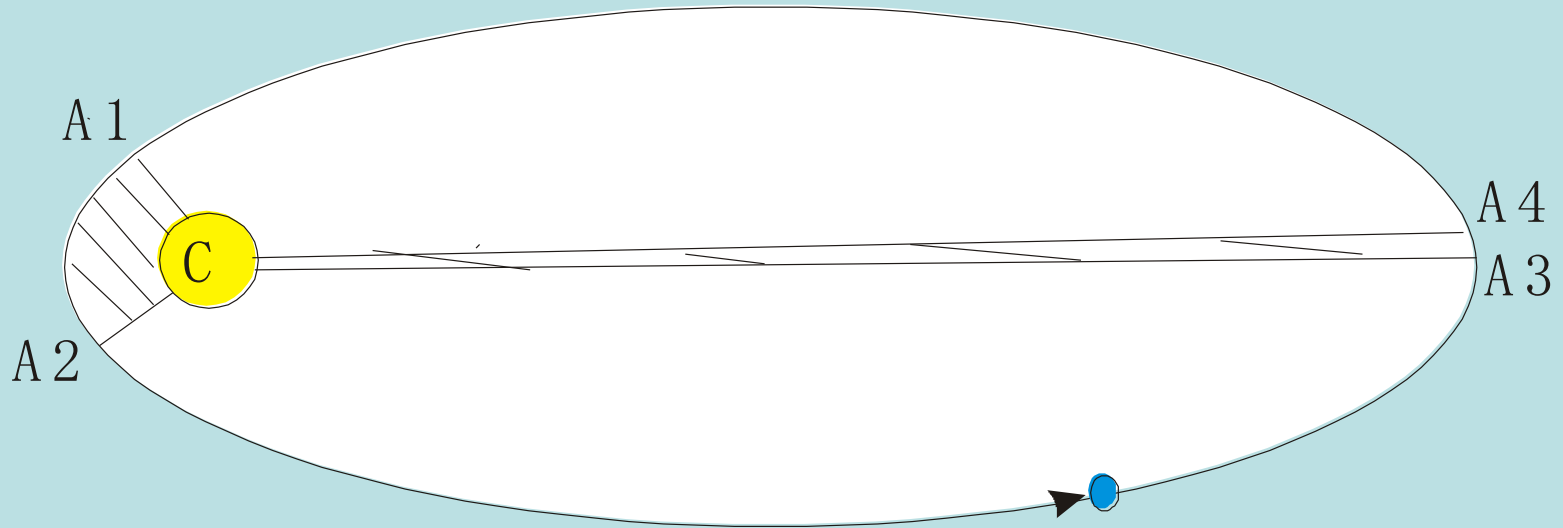


Fig. 2.7 A sketch showing the Kepler's Second Law

In figure 2.7, C is the position of the Sun, which is also one of the two foci, and A1 through A4 represent the different positions of the planet that revolves the Sun. The planet uses the same time interval when it travels from A1 to A2 or from A3 to A4. In other words, the area covered by A1-A2-C is equal to the area covered by A3-A4-C. That is to say, the planet must travel faster when it passes the **perihelion** (近日点) near the Sun and slower when it passes the **aphelion** (远日点) far away from the Sun.

C. The third law: the square of the time (for an orbiting cycle) divided by the cube of average radius is a constant.

“公转周期的平方与平均半径的立方成正比，”

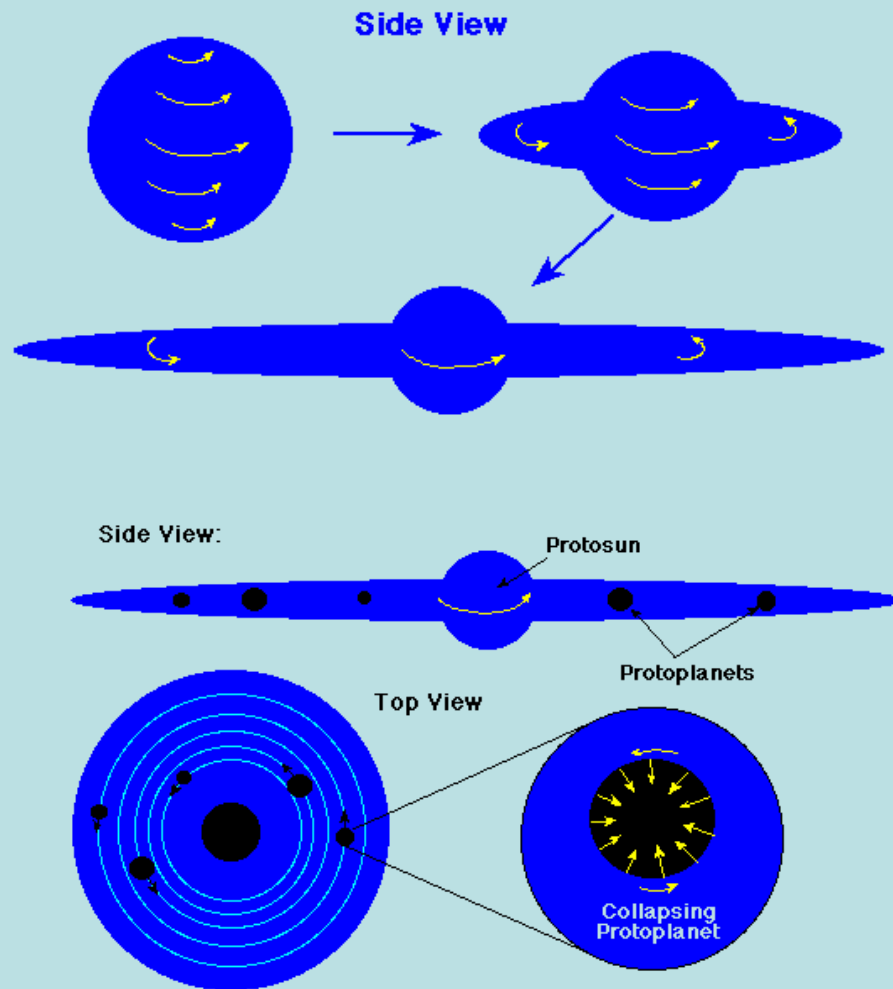
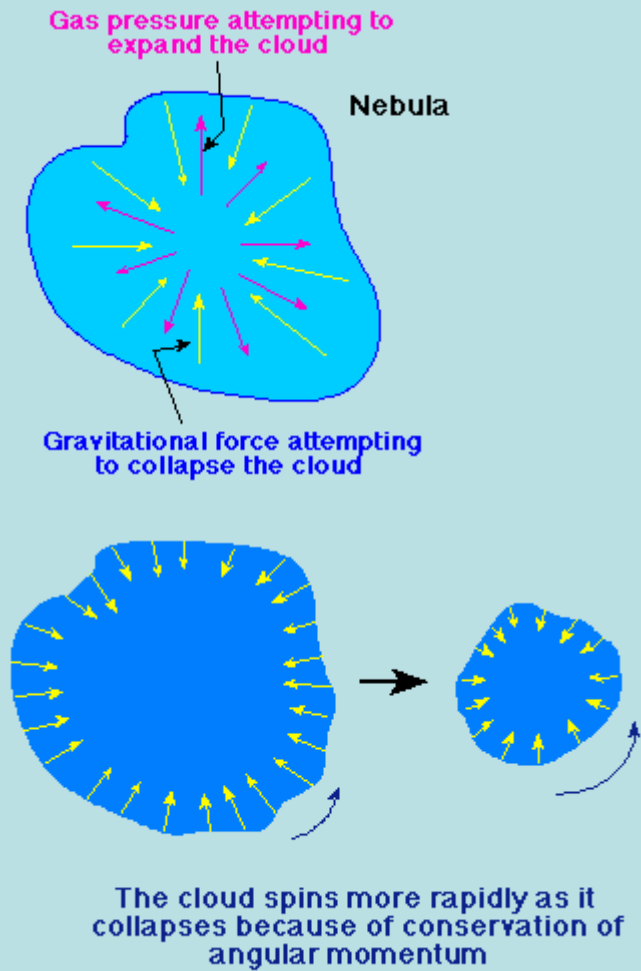
It takes 88 Earth days for Mercury to revolve the Sun one time, while it takes 248 Earth years for Pluto to revolve the Sun once. (水星公转一周88天，而冥王星则需要248年了)

$$\frac{T_1^2}{a_1^3} = \frac{T_2^2}{a_2^3} = \frac{T_3^2}{a_3^3} = \dots = K$$

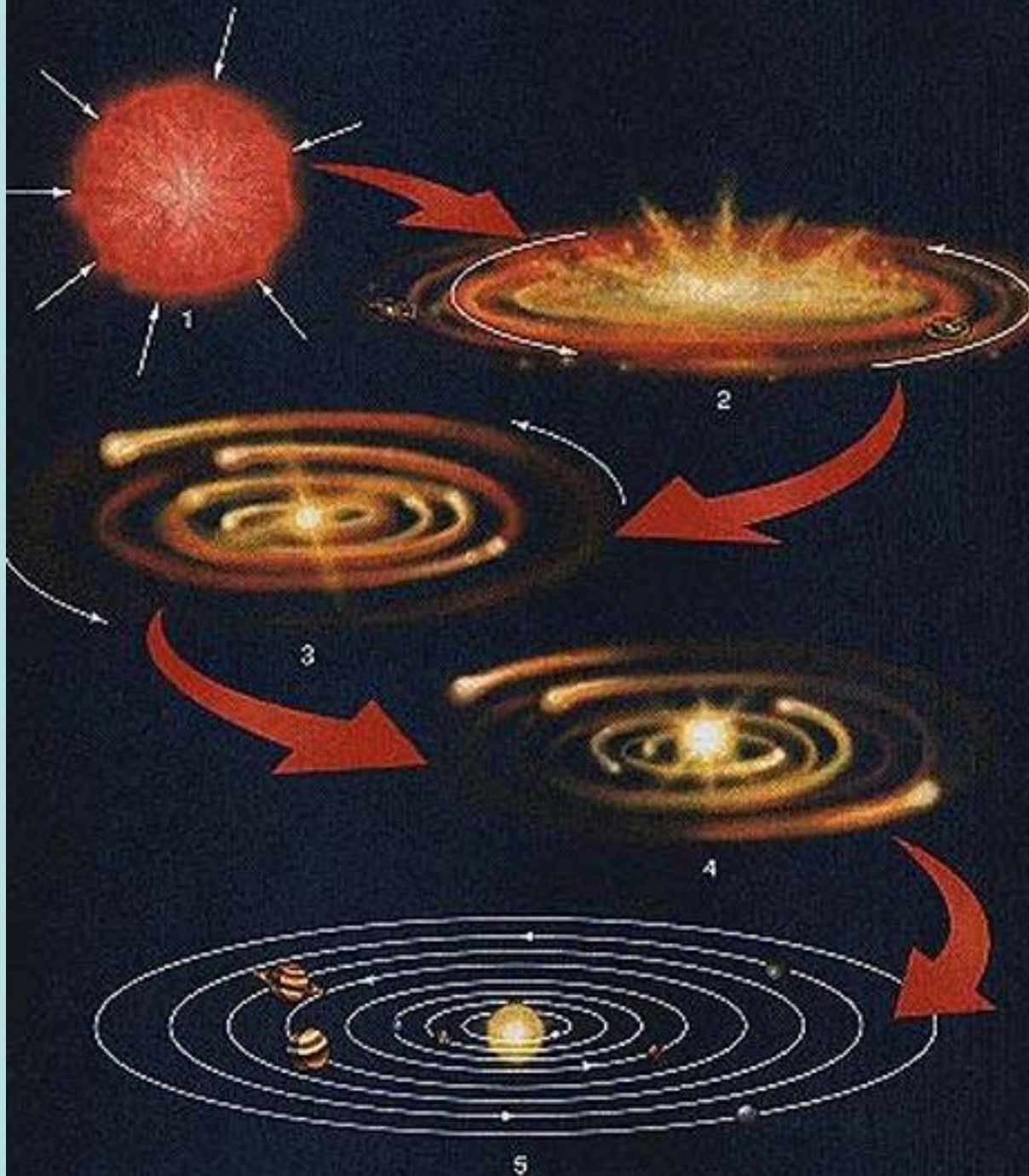
In the formula, T —time of period; a —average radius; and K —a constant.

2.4 The origin of the Solar System (太阳系的起源)

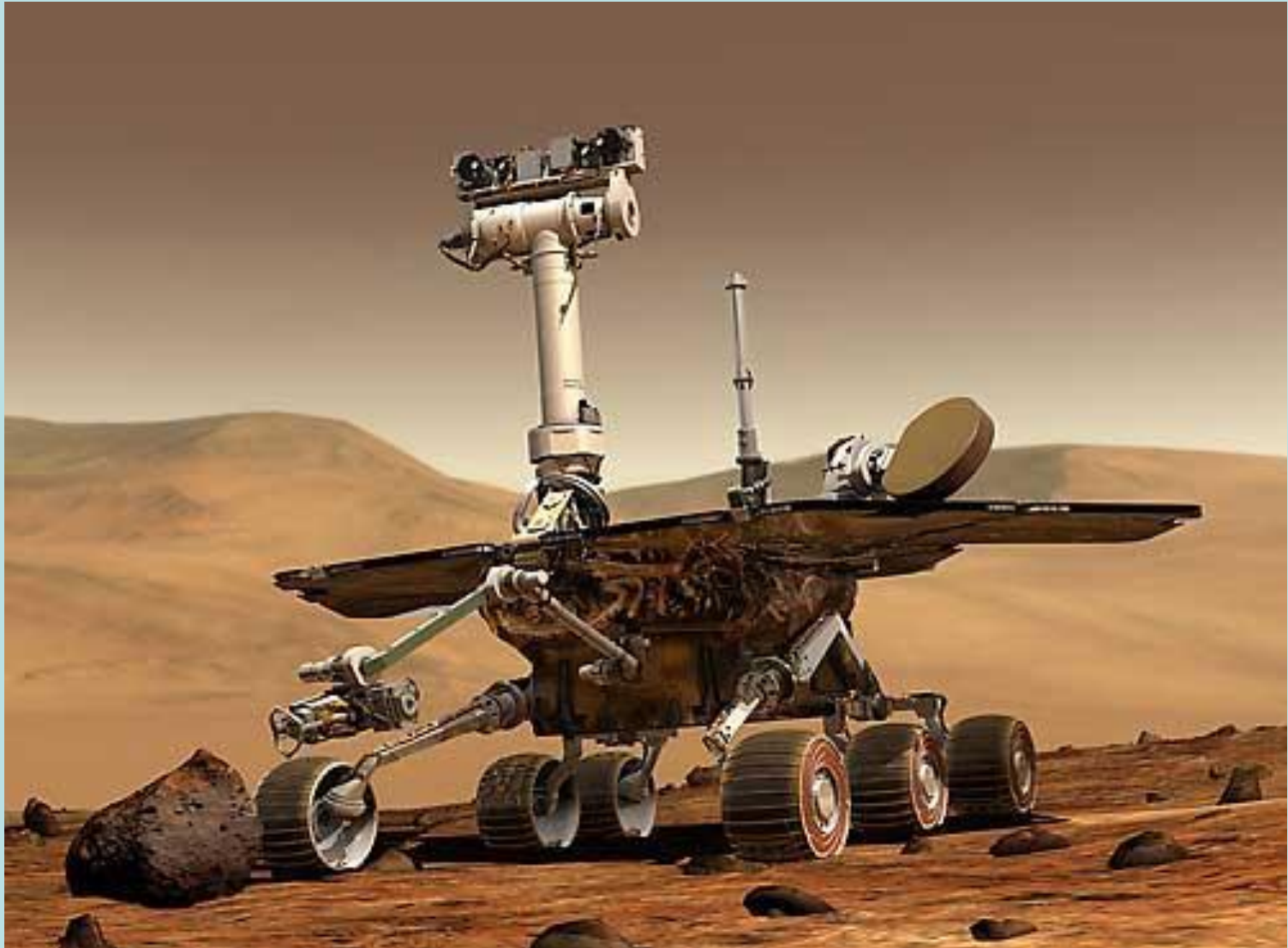
Nebular Hypothesis (星云说)



Origin of the Solar System



<http://www.aerospaceweb.org/question/astronomy/solar-system/solar-system.jpg>



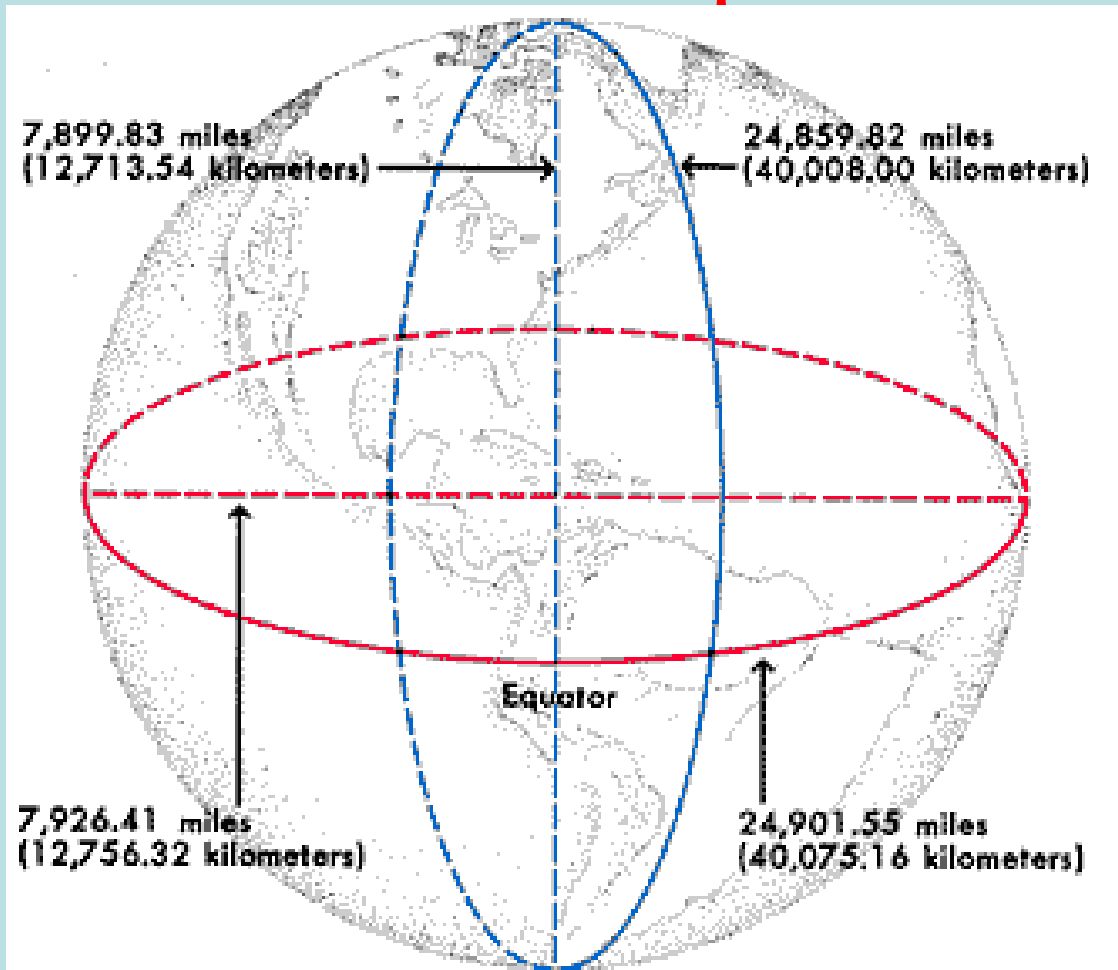
**Fig. 2.12 One of two Mars rovers is shown in image (News released by NASA)
(Adopted from <http://seattletimes.nwsourc.com> on Jan. 6, 2004)**

China's Shenzhou-7 mission passes final joint check

JIUQUAN, Gansu, Sept. 23 (Xinhua) -- China's Shenzhou-7 mission is ready for launch later this month after a final check of the spacecraft, the rocket and the ground operation system on Tuesday morning. Scientists simulated the ignition of the rocket and the in-flight moves of the capsule to test how the system and the observation, control and communication system at the Jiuquan Satellite Launch Center would work together.



2.5 The Earth's shape (地球的形状)



The Earth is not perfectly round. Distances measured through the poles are shorter than those at the equator.

World Book diagram

Fig. The Earth shape (Adopted from <http://www2.worldbook.com>)

Flattening (ellipticity): $1/298.257$ (椭圆率)
Semimajor axis: 6,378.14 km (半长轴----赤道半径)
Semiminor axis: 6,356.77 km (半短轴----两极半径)

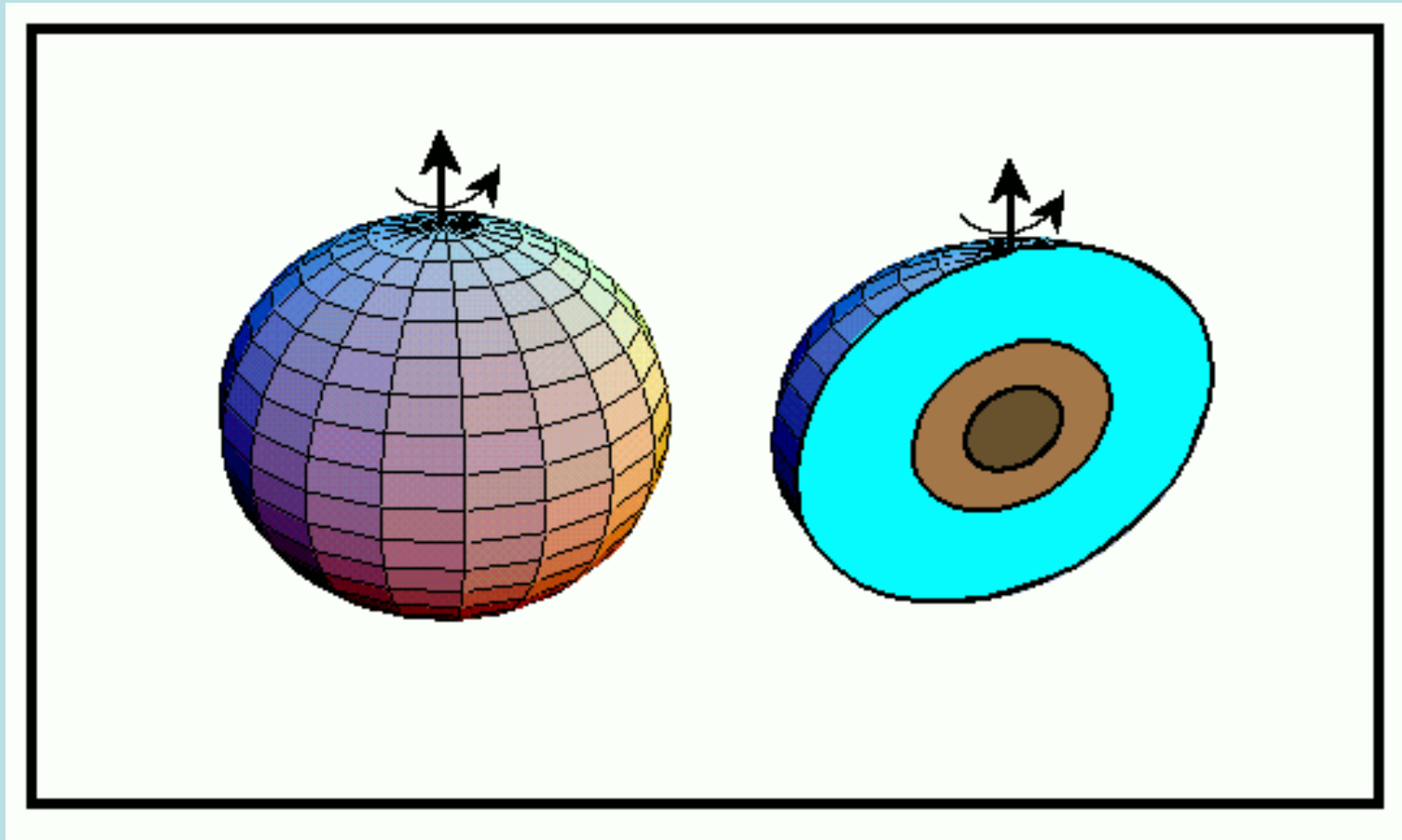


Fig. 2.14 A sketch showing the relationship between the Earth's shape and its rotation (Adopted from: <http://www.mines.edu>)

Some key points or questions in the chapter

The Sun contains 99.9% of the mass.

The Solar System is mostly empty space.

The Solar System is a flattened disk.

All planets revolve in the same direction

Most planets also rotate in the same direction

All objects have similar ages (about 4.6 billion years, when measurable).

The members of the Solar System: Sun, Planets, Comet, Satellites (moons), Asteroid, Meteorite, Cosmic dusts

Planets of the Solar System: Mercury, Venus, Earth, Mars, (Asteroids), Jupiter, Saturn, Uranus, Neptune and Pluto.

Which planet in the solar system has the largest density? How much?

A comet's compositions: Head (Coma and Nucleus), Tail (dust and ionized gas).

The meteorites can be divided into 3 categories: Stony meteorite, iron meteorite and stony-iron meteorite.

**Thanks
for your attention!**

