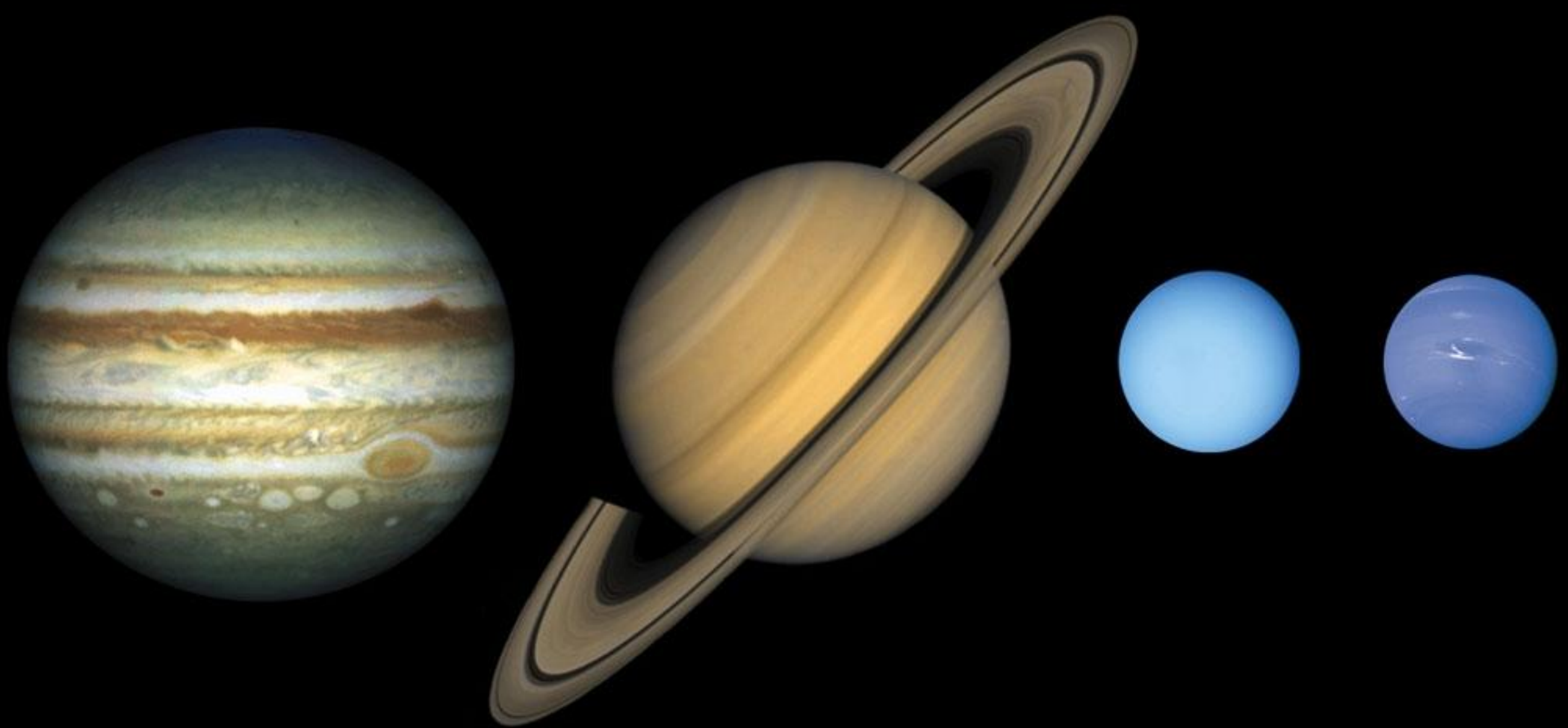


The Solar System



THE SUN

Core: It is a gravitationally bound stabilized fusion reactor, where energy is produced by conversion of hydrogen into helium according to Einstein's formula $E=mc^2$. Temperature=13,600,000 K, density=150 g/cm³.

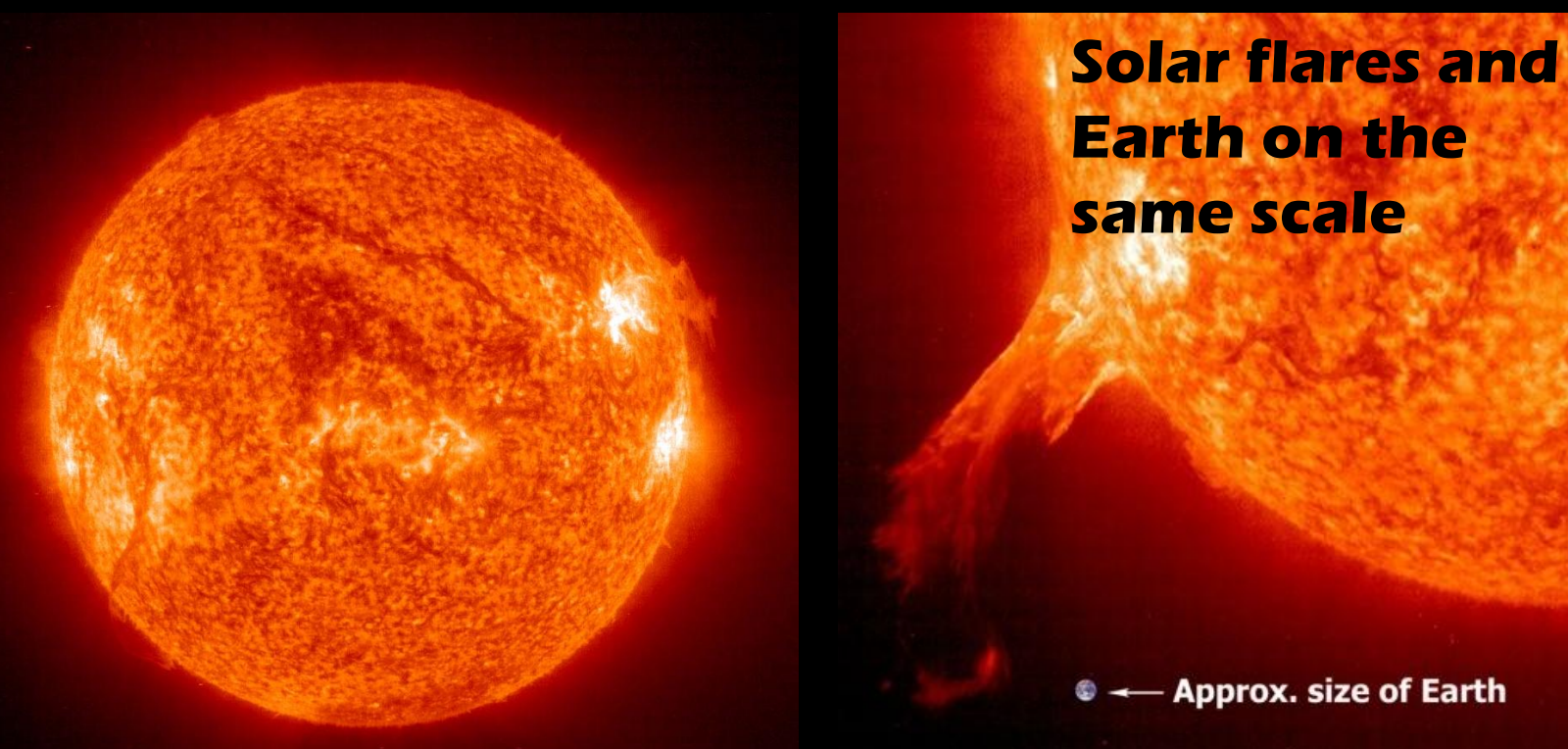
Radiative zone: From about 0.25 to about 0.7 solar radii, heat is transferred by radiation, temperature varies from 7,000,000 K to about 2,000,000 at the top of this zone.

Convective Zone: Forms outer shell of the Sun, starts from 0.7 solar radii to the bottom of the visible surface. Opaque to radiation; energy is transferred by convection. Density: 0.2 gm/cm³.

Photosphere: 500km thick layer above convection zone, opaque to visible light. Temperature: 5800 K, density is 0.1% of the density of air at sea level.

Chromosphere: A thin layer the Sun's atmosphere just above the photosphere, roughly 2,000 kilometres deep. More transparent than photosphere. It is visible during a full solar eclipse.

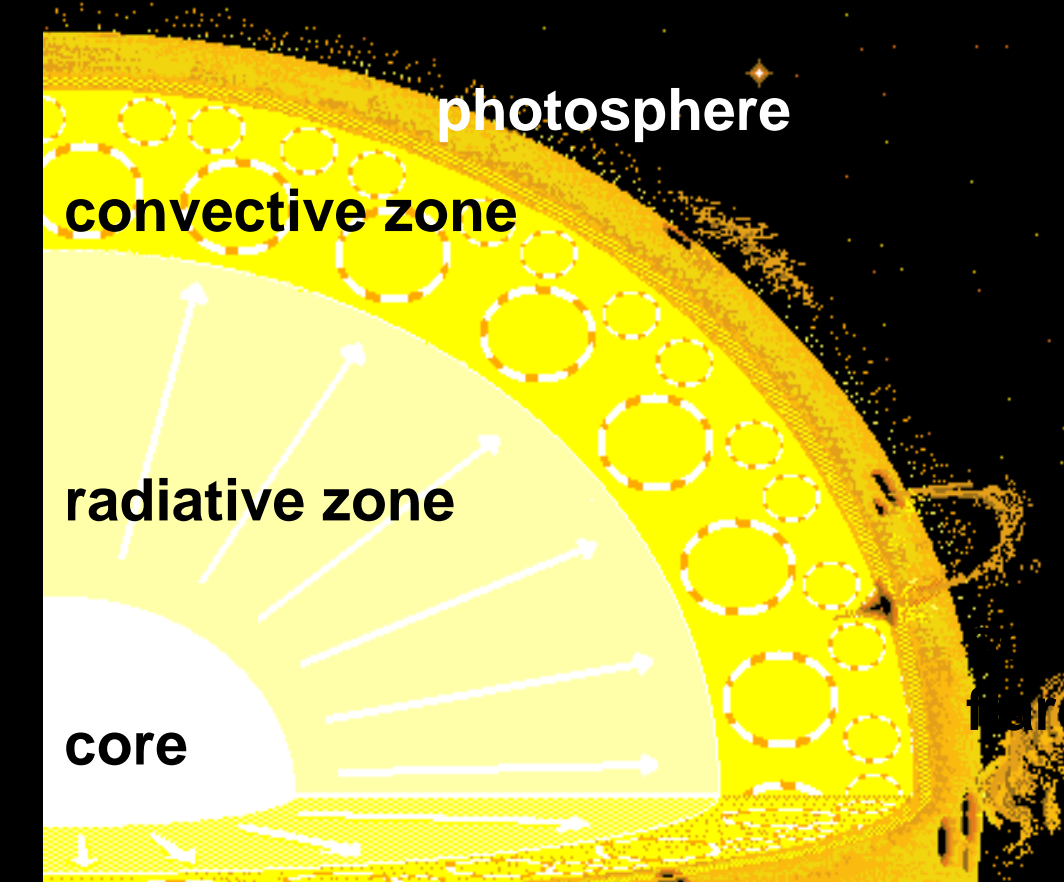
Corona: Extended outer atmosphere of the sun with extension up to ten solar diameters. Temperature is 200 times greater than at the visible surface of the sun.



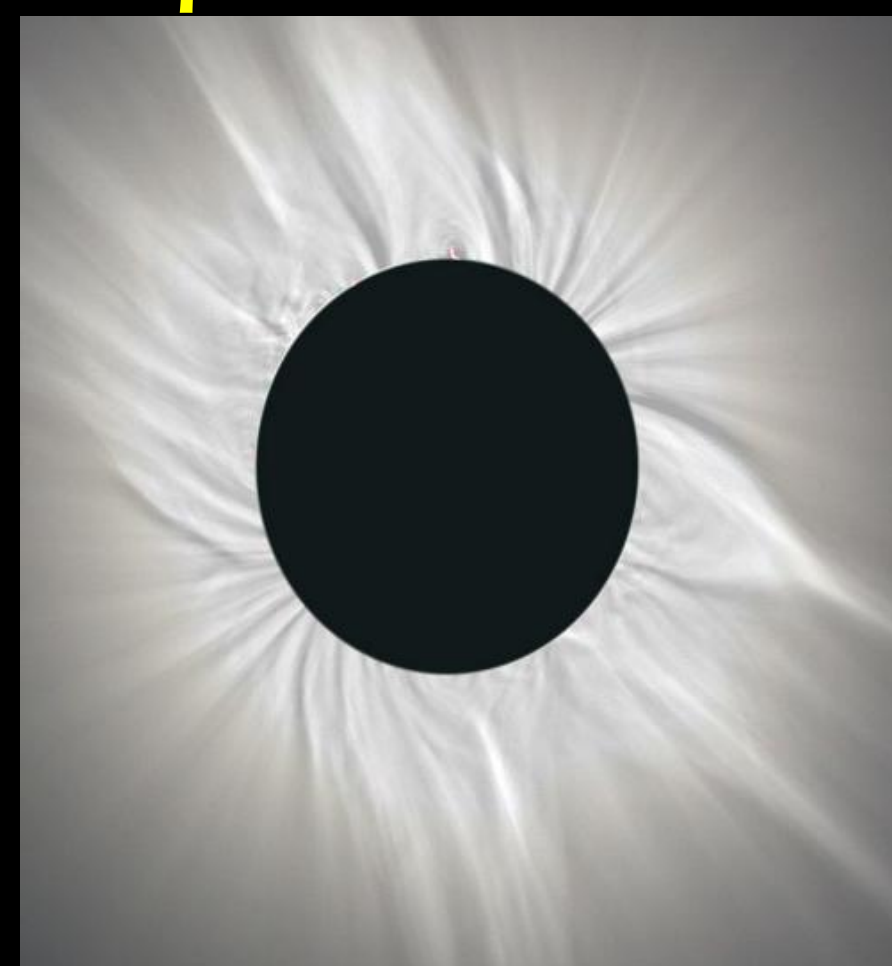
Solar flares and Earth on the same scale

— Approx. size of Earth

Different zones of solar interior



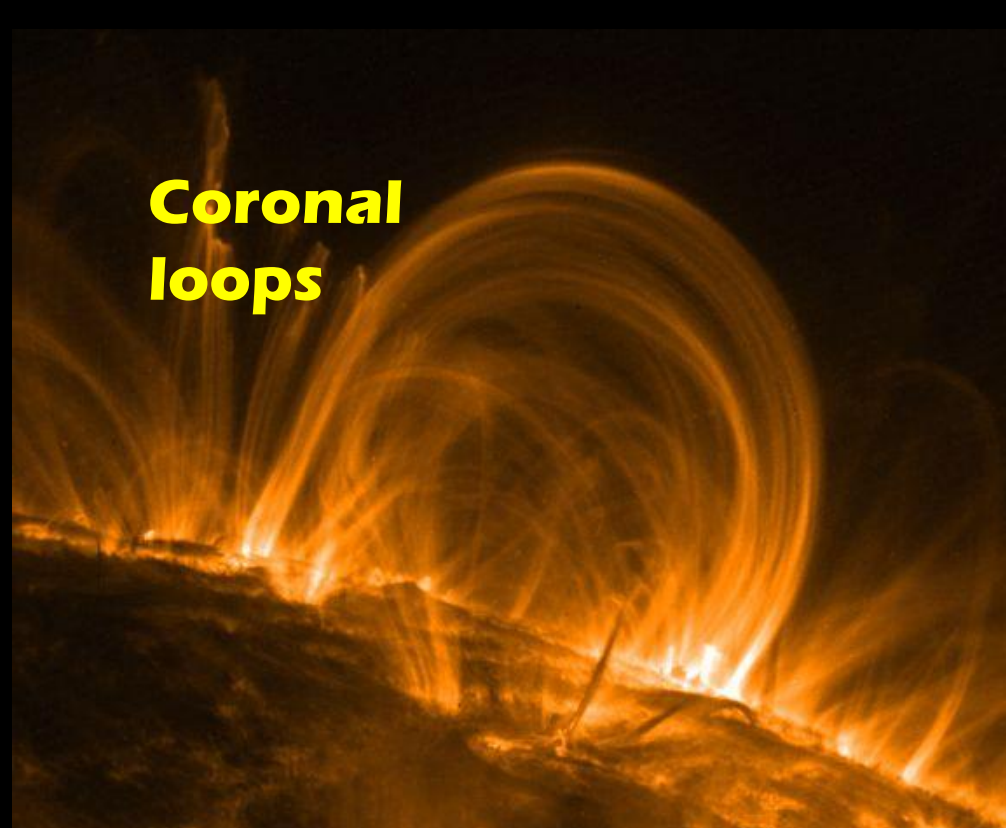
Corona visible during full solar eclipse



Sun spots: Dark blemishes on the photosphere. These are the cooler regions compared to their surroundings.



Earth and a sun spot on the same scale



Coronal loops



Mercury

MERCURY: As the planet closest to the sun, Mercury's year (orbital period) is only about 88 Earth days. At a maximum angular separation of only 28° from the sun, Mercury gets lost in the sun's glare and thus cannot usually be seen with the naked eye. The smallest planet in the solar system, Mercury's surface gravity, it turns out, is too weak to retain any significant atmosphere. Without an atmosphere to retain heat, and a long day (spin period) of about 59 Earth days, the planet's temperature varies considerably between daytime, when it can be as high as 450°C, and nighttime, when it can drop to as low as -180°C. Its surface is cratered like that of the moon, but unlike the moon, Mercury possesses a relatively large iron core which generates a magnetic field similar to, but much weaker than, that of Earth.

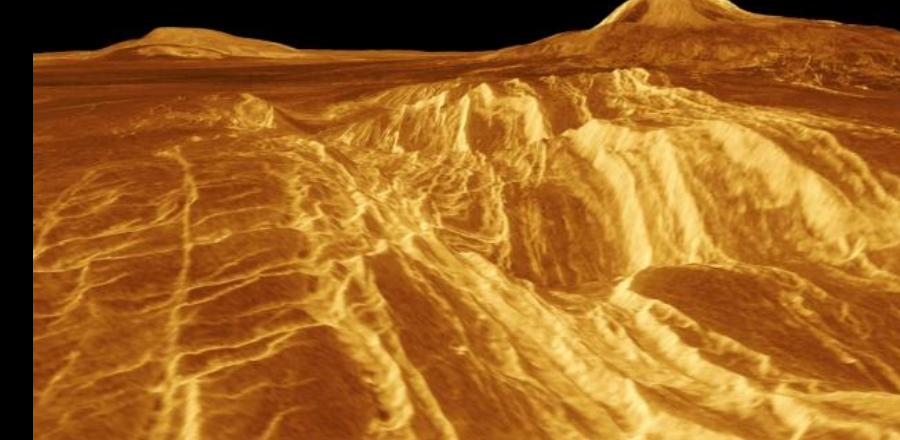


Venus

VENUS: The planet whose orbit brings it nearest to Earth, Venus is almost the same size and has nearly as much surface gravity as our planet. As its orbit is interior to our own, it has phases like those of the moon (first observed by Galileo); in fact, its smaller orbit means that it is always within about 47° of the sun in the sky, which is why it is known as the "morning star" and "evening star". At one point in its history, Venus might have been more Earth-like, but evaporation of water from its surface probably led to a runaway greenhouse effect; presently its dense carbon dioxide atmosphere and sulfur dioxide clouds trap much of the heat re-radiated by its surface, leading to a mean ground-level temperature of almost 500°C. Coupled with an atmospheric pressure almost 100 times that on Earth, Venus is far from paradise! Although Venus' dense clouds are opaque (in fact, they reflect most of the sunlight incident upon them, which is one of the reasons the planet is so bright), space probes have been able to gather information about the hidden surface underneath; we now know that much of it has been shaped by volcanism, which may still be ongoing.



Surface of Venus



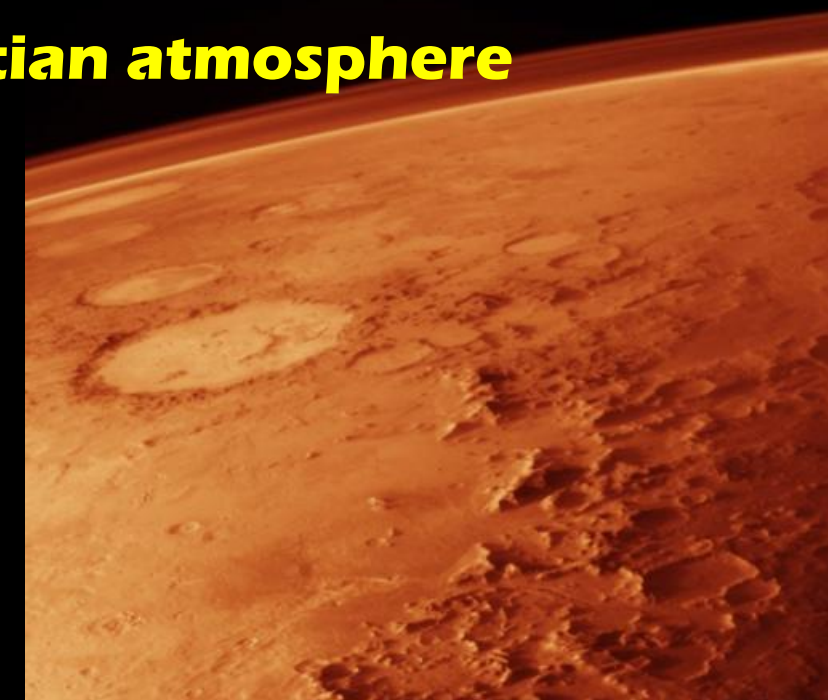
Great Red Spot



Earth

EARTH: The only planet known to harbour life, the Blue Planet has also been transformed by it. For example, the evolution of oxygenic photosynthesis 2.7 billion years ago led to the presence of a significant amount of oxygen in the atmosphere and the emergence of O₂-breathing life forms. Moreover, the ozone (O₃) layer helps to keep out ultraviolet radiation from the sun, which is harmful to many organisms, including humans. We also owe our existence to Earth's magnetic field, created by motions in its metallic core, which helps to shield us from energetic charged particles of the solar wind. In any case there are enough hazards on the surface, where earthquakes and volcanoes result from movements of the interlocking regions of the crust known as tectonic plates.

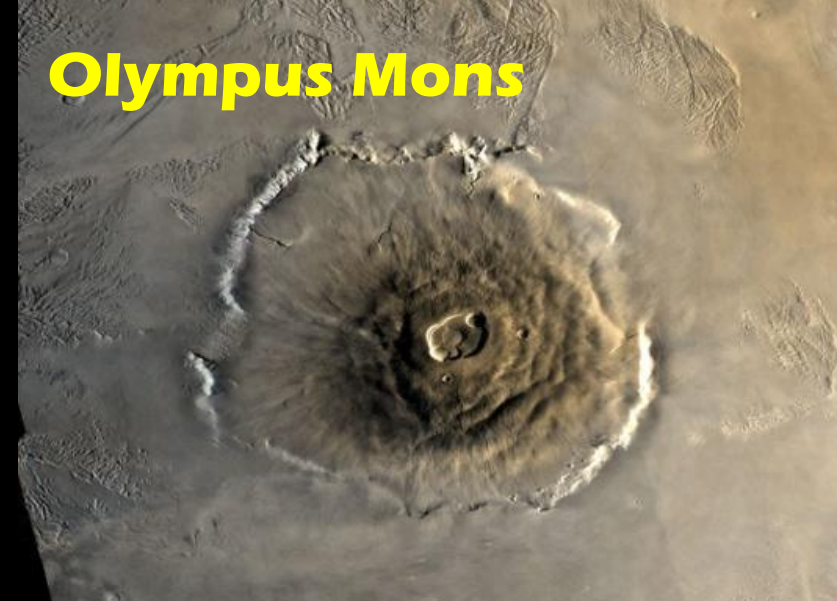
Martian atmosphere



Mars



Olympus Mons



MARS: With a diameter of about half, and mass of about 1/10 that of Earth, a 50 kg person on Mars would weigh only as much as a 19 kg child weighs on Earth. This low surface gravity helps make possible the existence of large variations in elevation, notably the (possibly extinct) volcano, Olympus Mons, which, at 3 times the height of Mount Everest, is the tallest peak in the solar system. Currently, Mars' temperature (from -87°C to -5°C) and atmospheric pressure (about 1% that of Earth) are too low to allow liquid water to exist for a long time on its surface, though ancient channels and other evidence accumulated by numerous spacecraft indicate that vast amounts of surface H₂O once flowed on Mars. Today, water still exists in the polar ice caps, in the permafrost layer below the soil and perhaps, some scientists speculate, deeper underground. The presence of water suggests the possibility of life, but solid evidence for organisms on the Red Planet, alive or extinct, has not been found.

ASTEROIDS: Also called minor planets or planetoids, these are relatively small rocky bodies typically found in the inner solar system, in a region called the asteroid belt, situated between the orbits of Mars and Jupiter. Most of them are irregularly shaped, as self-gravity is usually too weak to have smoothed them into a spherical form. It is believed that most of the asteroids in this belt have been ejected from the solar system since its formation, leaving a collection whose total mass is only about 4% that of the moon. Though objects in the belt are thinly dispersed, collisions between asteroids occur rather frequently over astronomical timescales, and it is thought that planets form by the gradual accumulation of such objects. So why did the asteroids not form a planet? Blame the effects of Jupiter's strong gravitational field. Nevertheless, more than half the mass of the belt is contained in the 4 largest objects: Ceres, Vesta, Pallas and Hygiea, so some coalescence has occurred (Ceres, with a diameter of 950 km, is known as a dwarf planet).



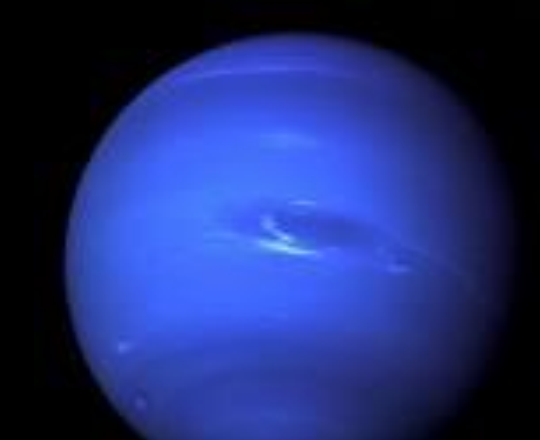
Asteroid



Major dusty ring of Saturn



Uranus with its faint ring system (computer-generated)



Bluish tint of Neptune

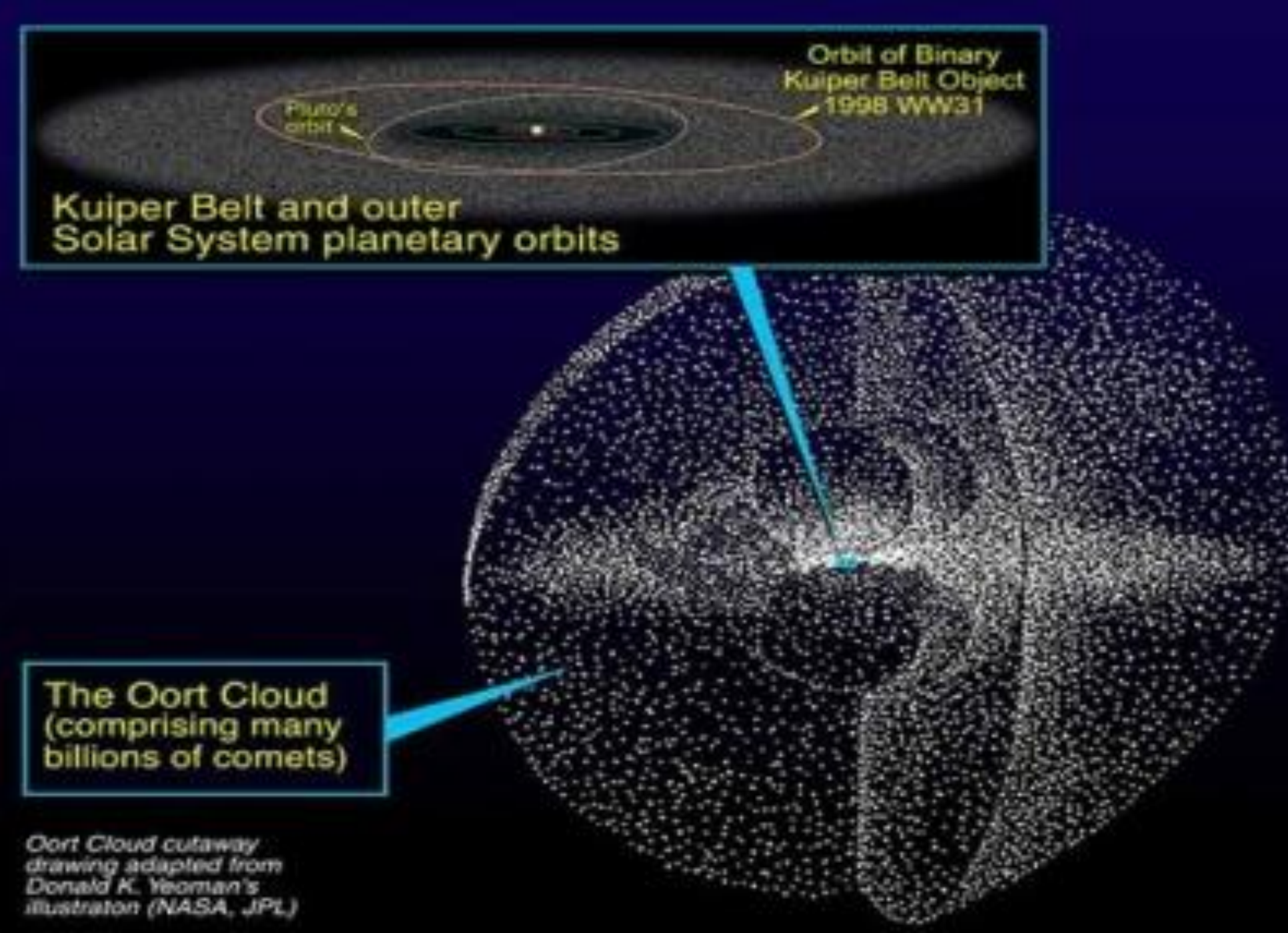


Jupiter after the impact of comet Shoemaker-Levy 9

COMETS: Loose collections of ice, dust and rock, these bodies measure a few hundred to tens of kilometers across, and in some cases are visible to the naked eye as they make a periodic pass through the inner solar system. Most comets exist in relatively stable orbits within two regions: the Kuiper belt, situated beyond the orbit of Neptune, and the Oort cloud, a vast spherical reservoir that lies tens of thousands of times farther from the sun than Earth. (Long included as a planet, Pluto is now classified as a dwarf planet, and probably the largest member of the Kuiper belt.) Occasionally, comets get perturbed gravitationally by a planet (Kuiper belt), or a passing star (Oort cloud), sending them on elongated orbits that bring them close to us. When near to the sun, solar radiation causes certain frozen materials within the comet to vaporize, resulting in a very thin atmosphere, or *coma*, and spectacular tails of gas and dust.



Comets in the inner solar system



Kuiper Belt and outer Solar System planetary orbits

The Oort Cloud (comprising many billions of comets)

Oort Cloud cutaway drawing adapted from Donald A. Koster's illustration (NASA, JPL)

JUPITER: The nearest Jovian planet to earth, with a mass about 318 Earth mass and diameter about 11 times earth diameter it is so big that all the other planets in our solar system could fit inside it.. Its mean distance from the sun is 5.2 AU with a revolution period of 11.86 earth years. It takes 5 minutes more time for a full rotation near the pole compare to the equatorial rotational period 9hour 50 minutes. There is about 82 % hydrogen, 18 % helium and traces of nearly all other elements in it. Polar Regions are believed to be ammonia ice crystal. Its atmosphere is full with turbulent activity which give rise to many peculiar features, one of which is Great Red Spot whose present size is slightly larger than the earth. It has faint ring systems and the maximum number of moons which are 63 to the present observation. The largest moon of the solar system Ganymede belongs to it as well.



Asteroid

Ring system of Saturn