

Lesson 08

Venus

Lesson 07

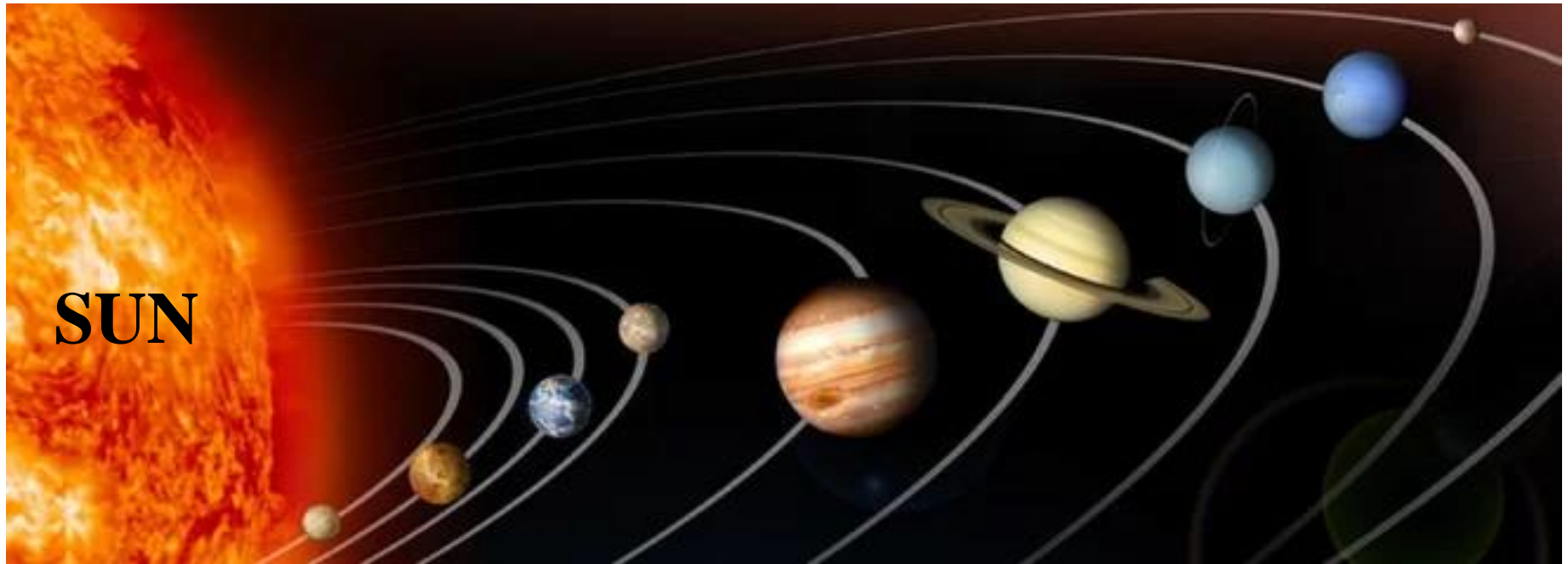
Part 2

Venus



4 Terrestrial planets
(small inner planets)

4 Jovian planets
(large outer planets)



Additional bodies in the solar system: Moons, comets, asteroids, dwarf planets, and dust.



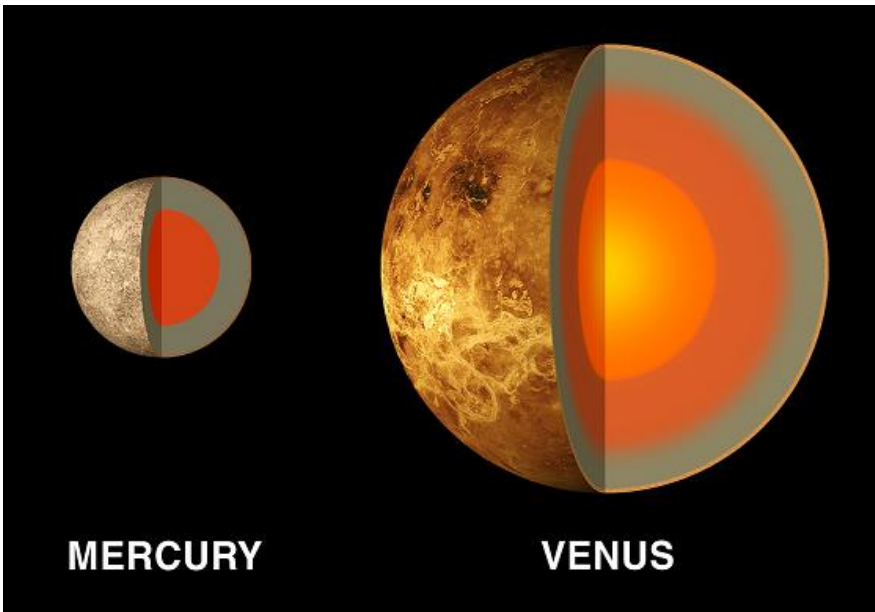
Terrestrial Planets: “Earth-like”



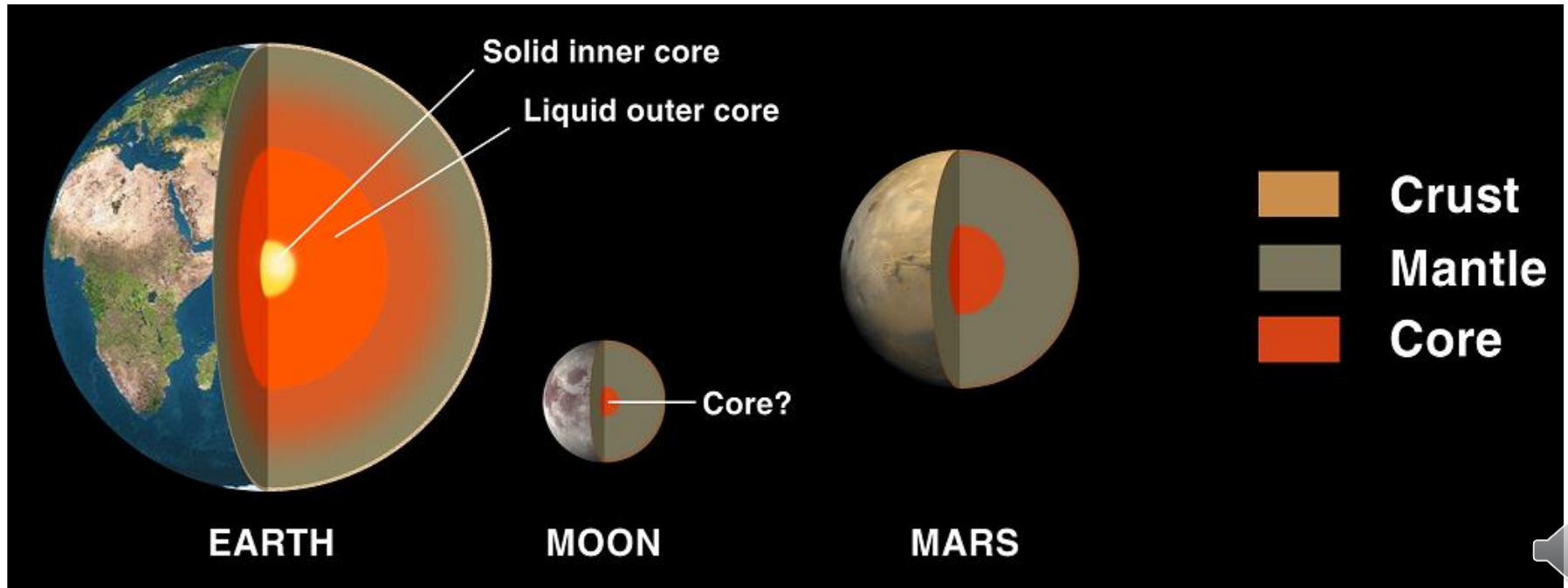
Mercury, Venus, Earth & Mars

- Small in size.
- Inner solar system. Orbit closest to the Sun.
- Made of rock and metal.





Terrestrial Planets have a thin rocky crust, a thicker denser mantle made of rock, and an iron & nickel core. The thicknesses and depths of their mantles and cores vary.



	Atmosphere Composition	Atmosphere Pressure (Atmo)	Avg. Surface Temperature
Mercury	None	None	430°C Day -180° Night
Venus	96% CO₂ 4% N₂ H₂SO₄ clouds	90	460°C
Earth	78% N₂ 21% O₂ H₂O clouds	1.0	15-20°C
Mars	95% CO₂ 3% N₂ H₂O, CO₂ clouds	0.007	-70°C

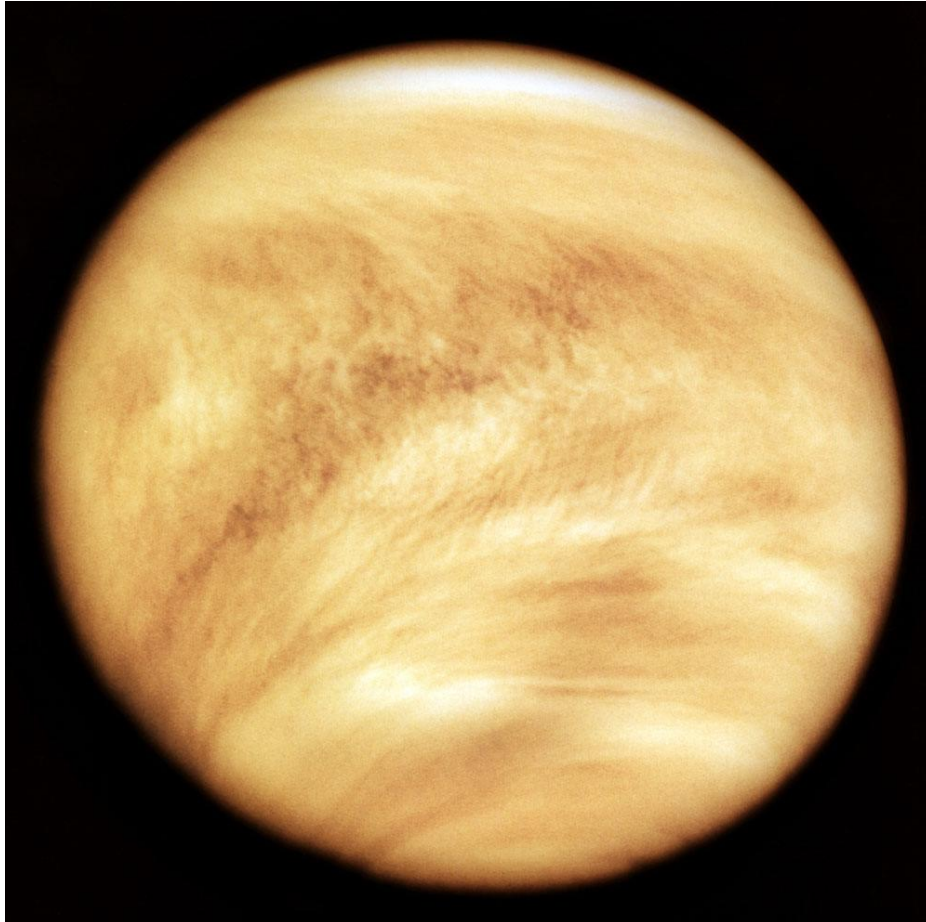


VENUS

- Equatorial diameter = 12,102 km
- Planetary mass = 4.87×10^{24} kg
- Bulk density = 5.25 g/cm^3
- Mean orbital radius = 1.08×10^8 km (0.72 AU)
- Orbital period = 224.7 days (0.62 yrs)
- Rotational period = 243.0 days (retrograde)
- No moons
- Axial tilt = 177° (almost upside down)
- Atmosphere (% mass): 96% $\text{CO}_2(\text{g})$, 3.5% N_2 , 0.5% bright yellow clouds made of H_2SO_4 .
- Atmosphere is 90-times more massive than Earth's.



The Venusian surface cannot be seen from space through Venus's dense clouds and atmosphere.

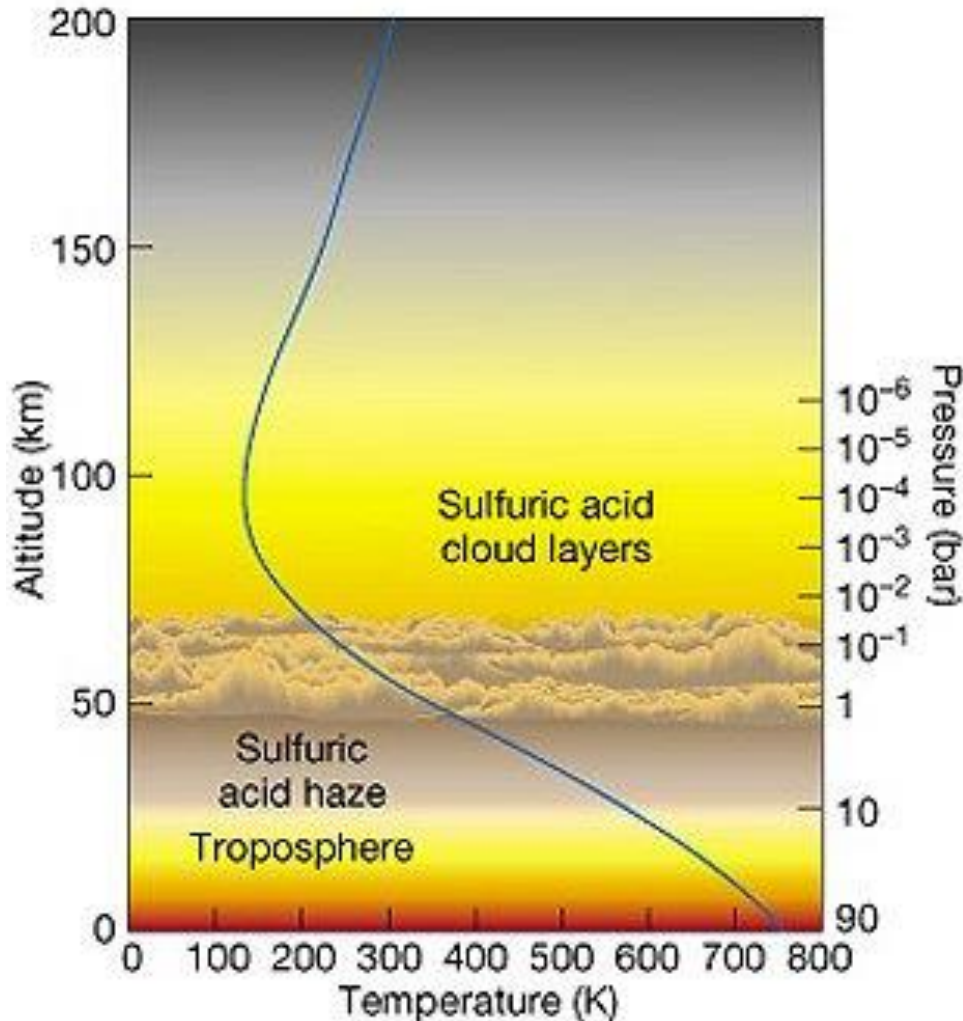


Venus is the *2nd brightest object* in the night sky.

Venus's bright yellow *sulfuric acid clouds* are very reflective.



Venus's atmosphere is *90-times more massive* than Earth's at ground level. The atmospheric pressure will crush any satellite that may land on the surface.

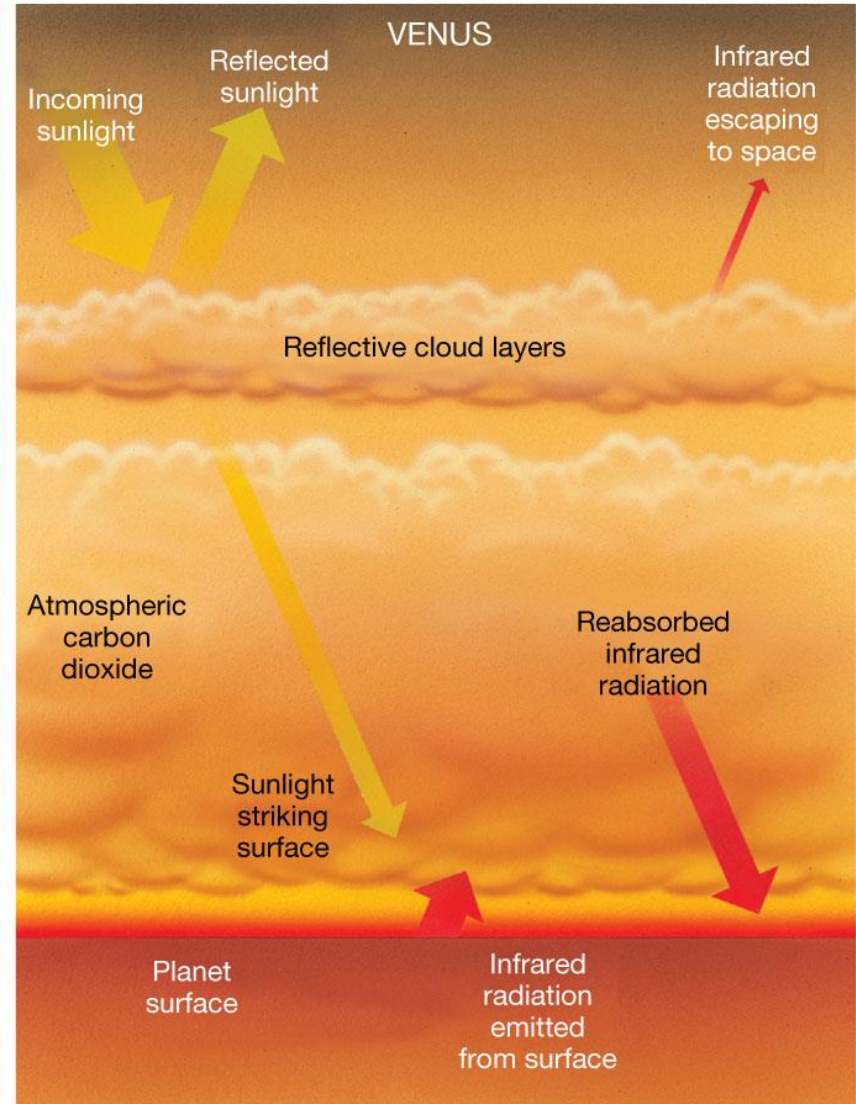
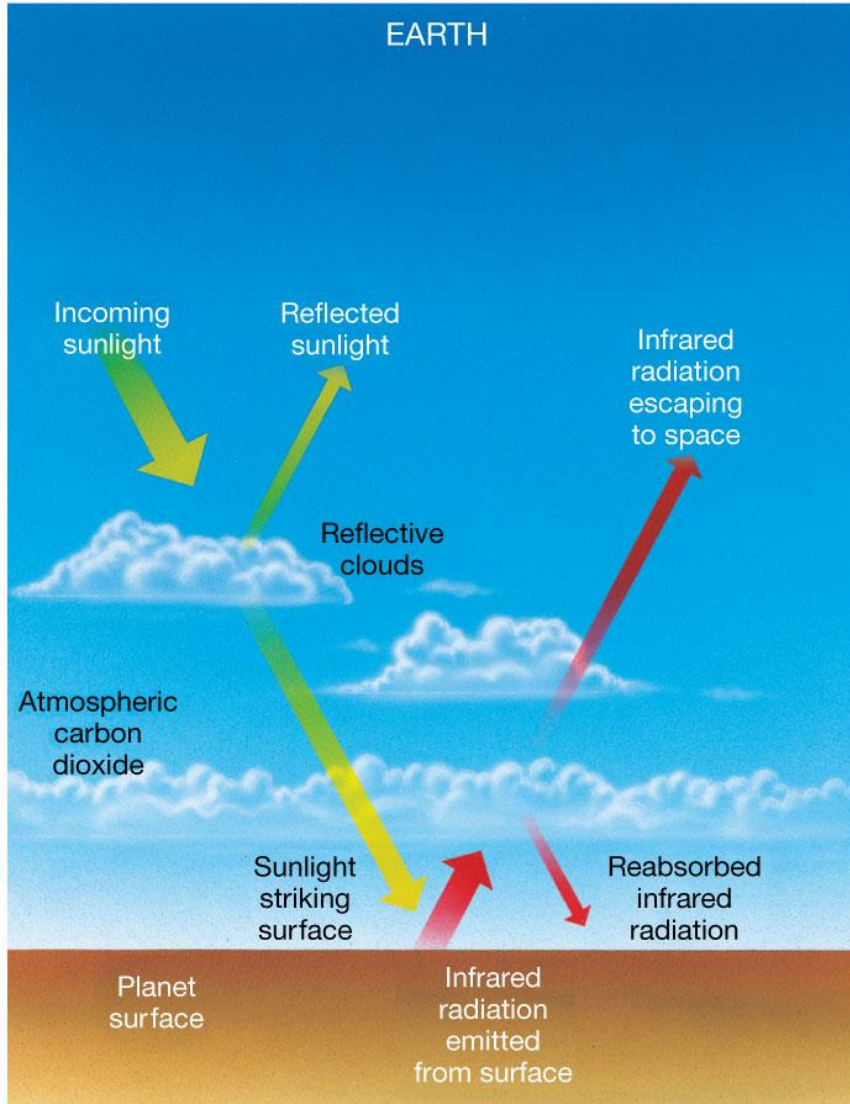


The stratospheric clouds are made of *sulfuric acid* droplets.

The volcanic gases SO_2 and H_2S oxidize in the upper atmosphere and combine with water vapor to yield sulfuric acid.



Comparison of Earth's mitigating *greenhouse effect* and Venus's irreversible *runaway greenhouse effect*



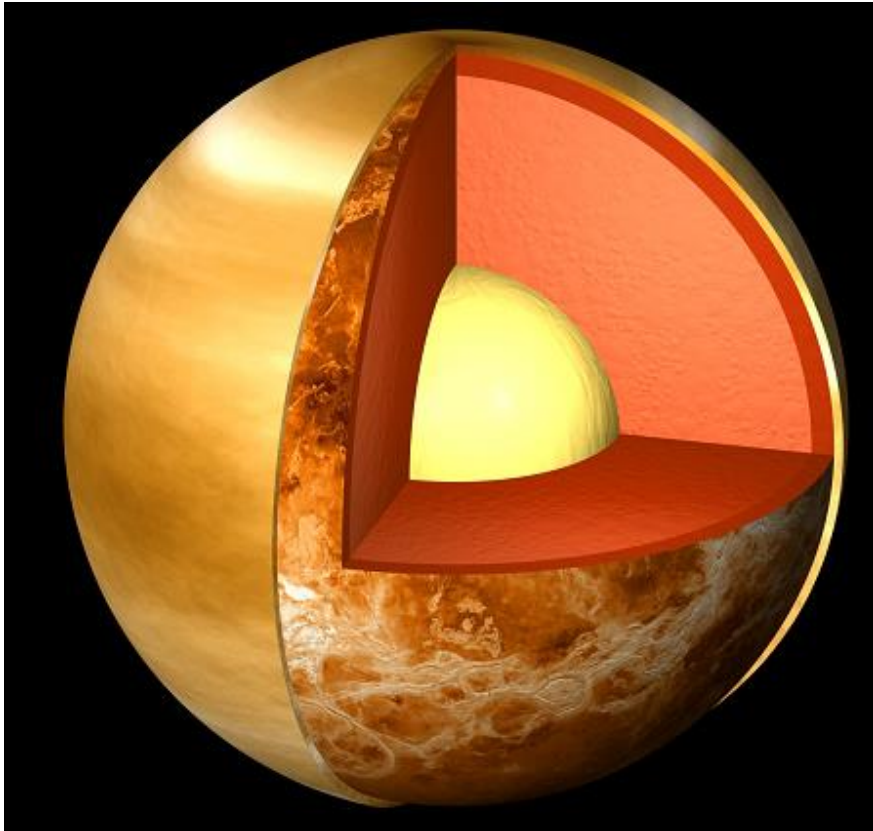
Venus is the hottest planetary object in the solar system. Venus's average surface temperature is $\sim 460^\circ \text{C}$.

Venus is undergoing an irreversible *runaway greenhouse effect*.

- 96% CO_2 in the atmosphere at $\sim 28,000,000$ times the quantity in Earth's atmosphere—absorbs most of the infrared and allows less to exit to space.
- Widespread volcanism adding heat and more greenhouse gases to the atmosphere.
- Closer to the sun—more concentrated sunlight intercepted by the atmosphere



Venus is approximately the same mass and diameter as Earth. The active volcanism on the surface suggests that



most of Venus's outer core is still molten and the mantle is very hot.

Geodesy and gravity anomaly measurements indicated that Venus's iron cores are slightly smaller than Earth's.

Venus lacks an internally-generated magnetic field due to its *extremely slow rotation*.



The Venusian surface was mapped using *radar* from orbiting satellites in the 1970s, 1990s, and 2000s.



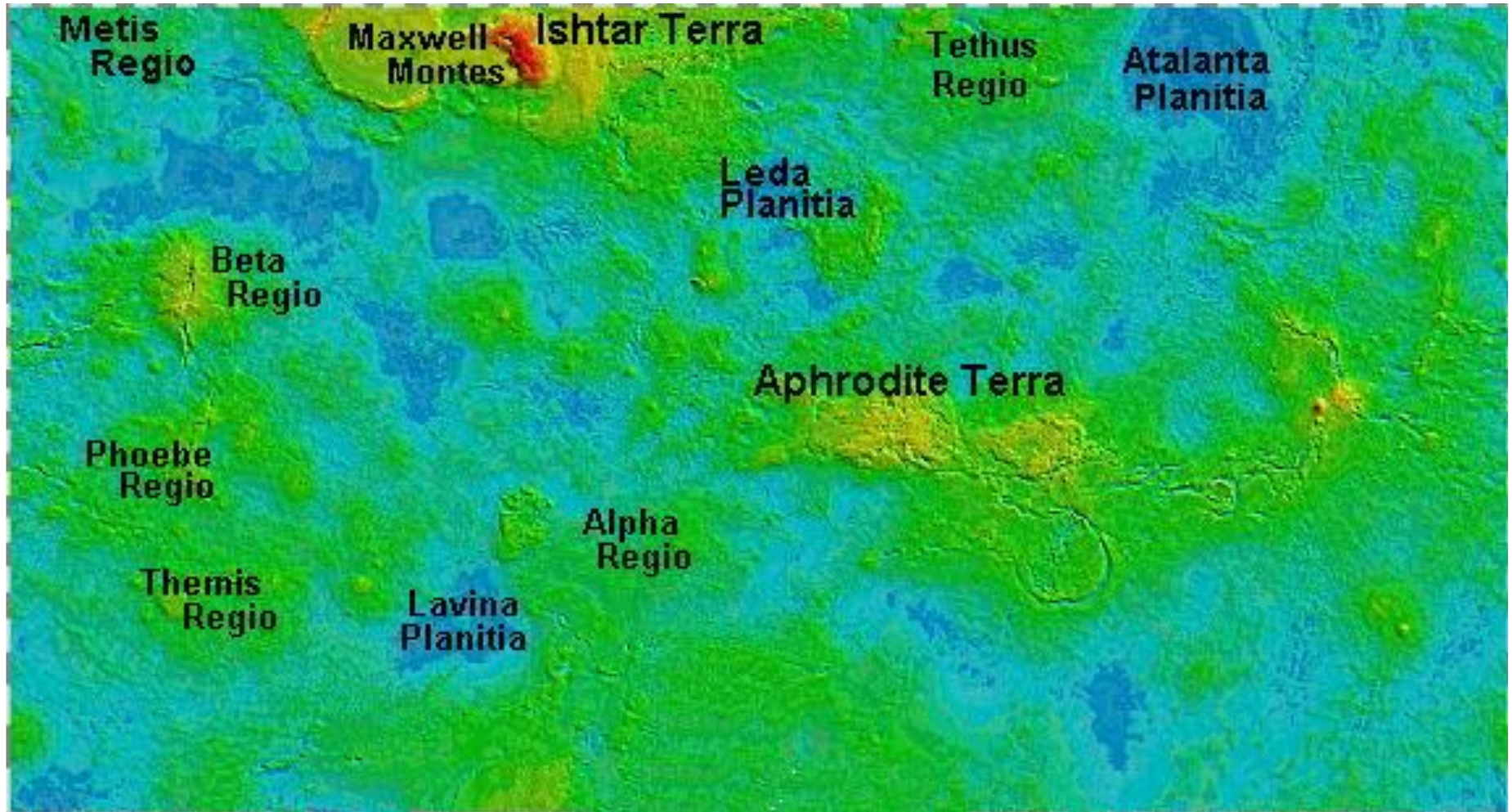
Venus's surface has “continent-like” highlands and “ocean-like” basins.

Very volcanically-active, covered with lava flows, active volcanoes, and volcanic mountain ranges.

Too hot for liquid water or ice to exist in the basins.



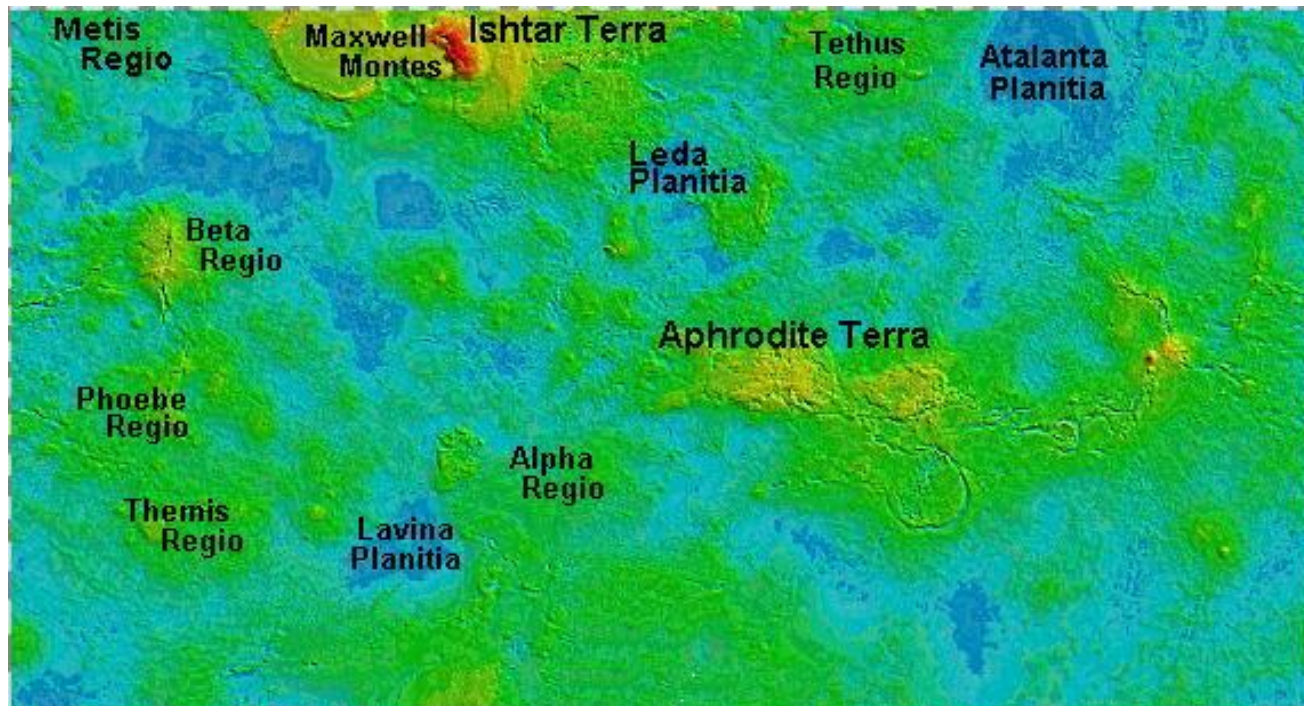
False-color relief map of Venus's surface

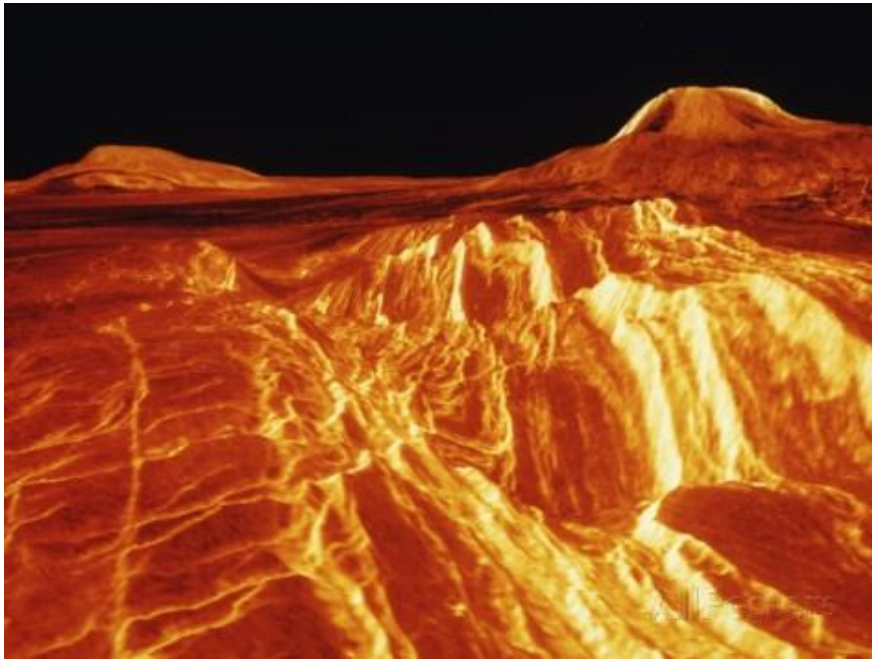


Regio: “region” plateau-like highlands, comparable to Earth’s “continents”.

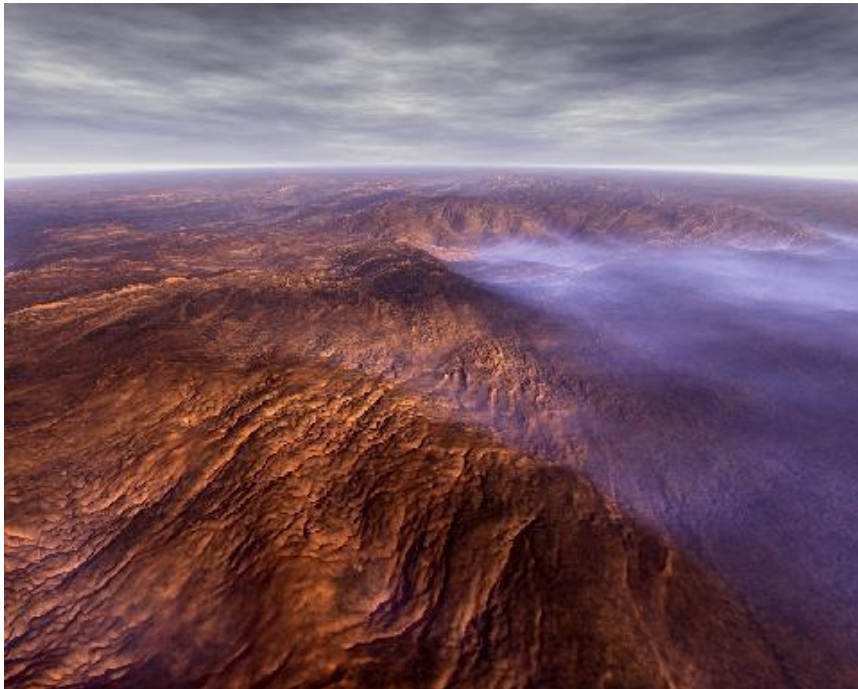
Planitia: “level plain” deeper flat-bottomed lowlands and basins, comparable to Earth’s ocean basins.

Terra: “Land, continent” mountain ranges



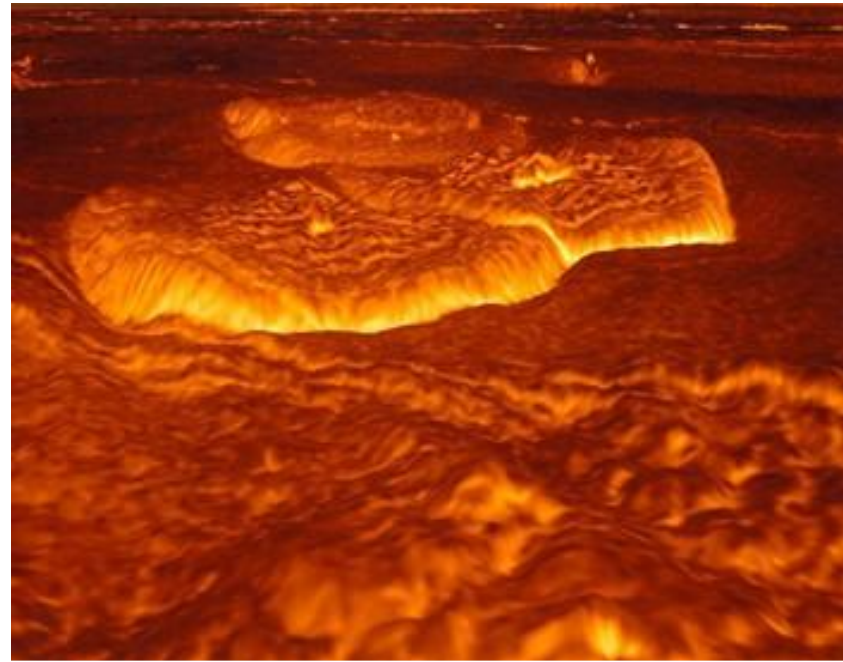
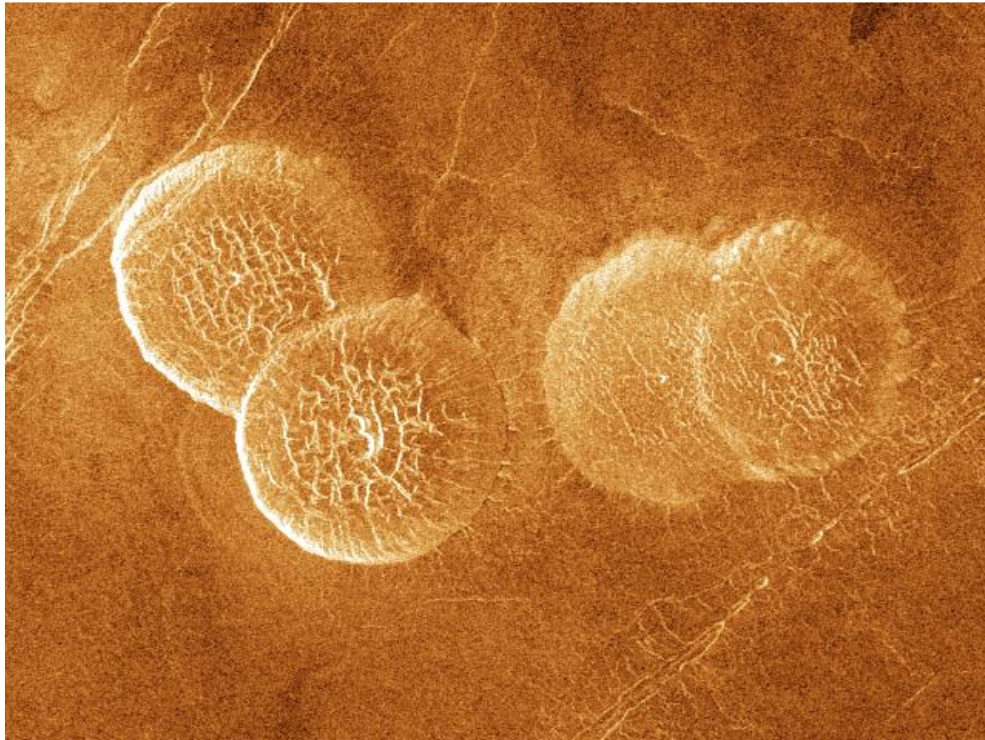


Sif Mons and *Gula Mons* are two of the largest Venusian volcanoes, measuring 3-4 km in elevation and ~300 km in diameter.



Maxwell Montes is the highest mountain range on Venus, located on the Ishtar Terra. Maxwell Montes has an average elevation of ~11 km.





Pancake Domes: volcanoes that form circular flattened disks instead of raised volcanic peaks. As lava erupts from the volcano's vent, the crushing atmosphere flattens the lava outward. Over time, the lava layers accumulate creating raised circular structures.



Venus's day-night cycle is longer than its orbit period.

- Venusian day = 243 Earth days
- Venusian year = 224 Earth days



Venus's axial tilt = 177° , tentatively upside down. Venus's north and south poles are inverted compared to the other planets. As a result of Venus being upside down, the rotation is **retrograde**, or backward/opposite to the other planets.

Venus was probably hit by a small planet early in its history to flip its orientation and make it spin backwards

