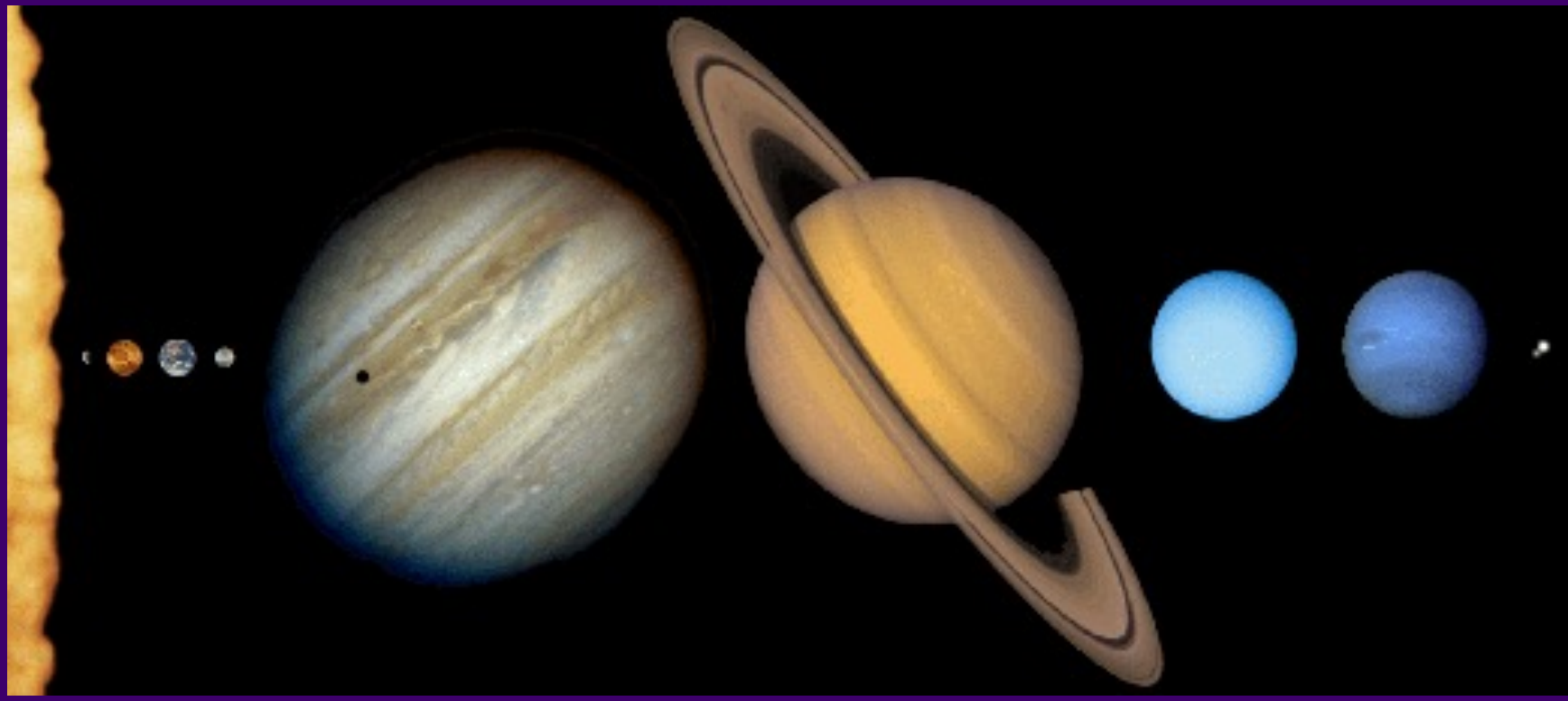
The Terrestrial Planets

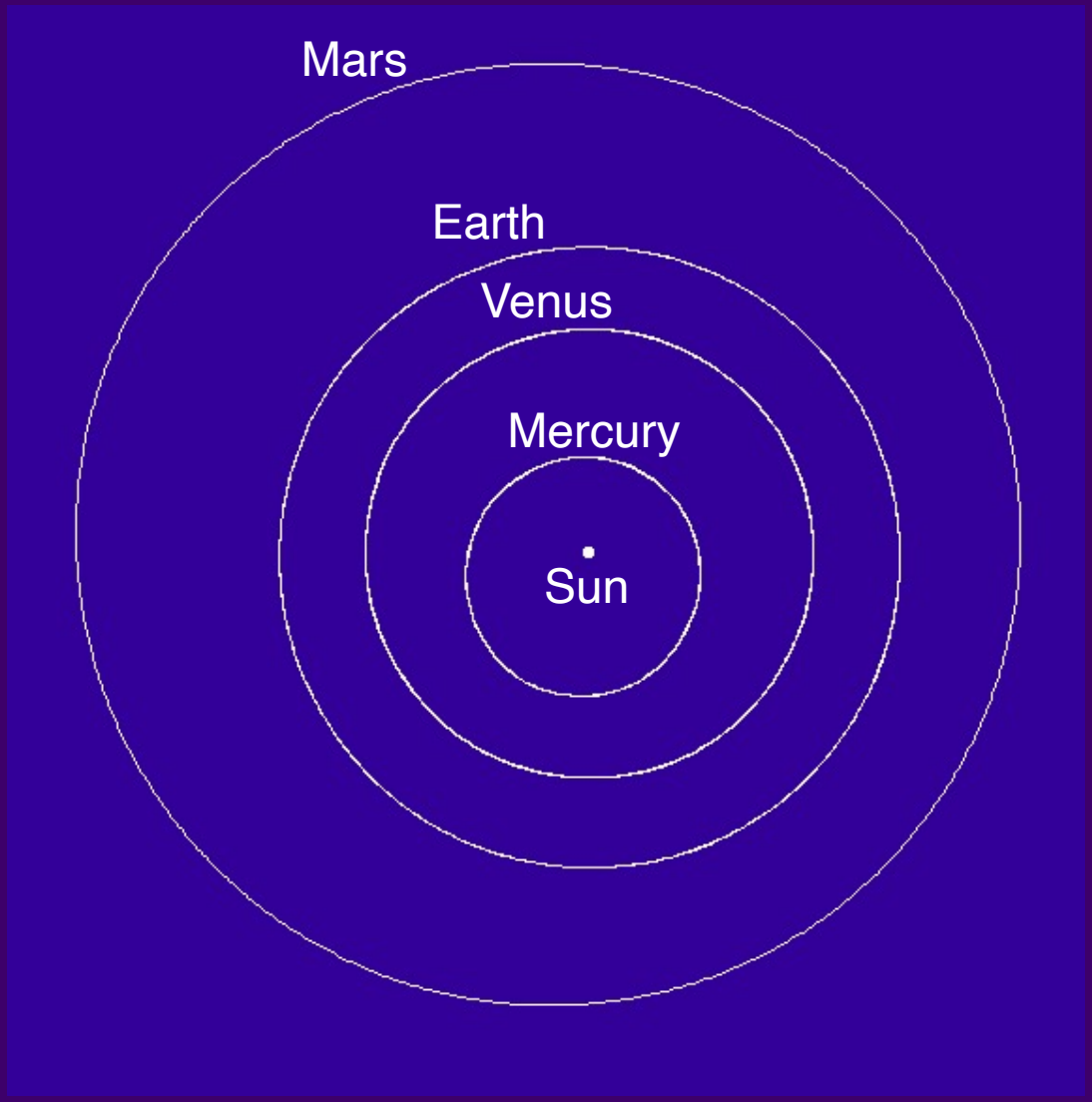
Today:

- Tour of the inner solar system: Mercury, Venus, Earth, Earth's moon, and Mars
- Sizes, masses, geology, atmospheres, temperatures, life

The planets, to scale



The Inner Solar System



On this scale:

1 A.U. = 120 pixels

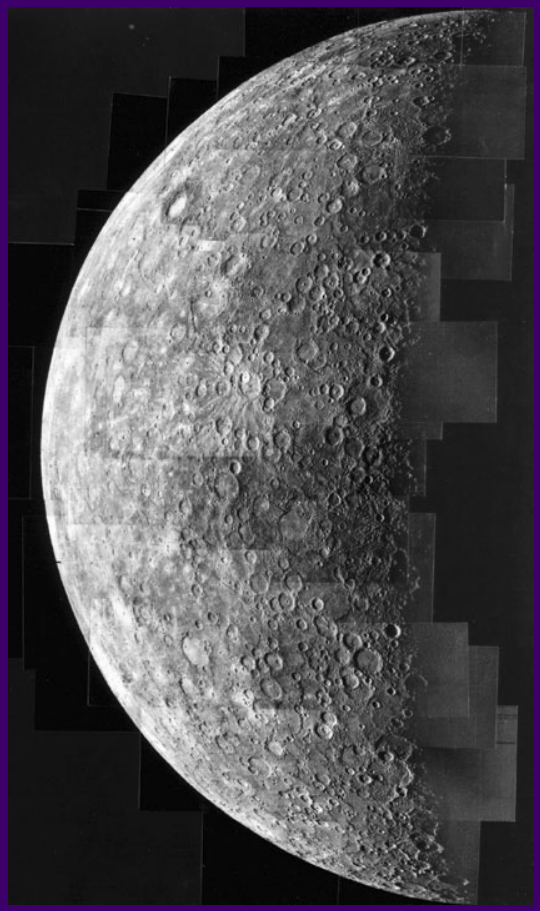
Diam. of Sun = 1 pixel

Diam. of moon's orbit = 1/2 pixel

Diam. of earth = 1/100 pixel

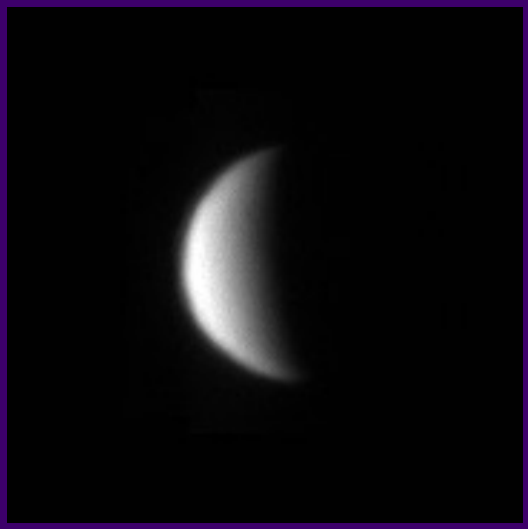
Mercury

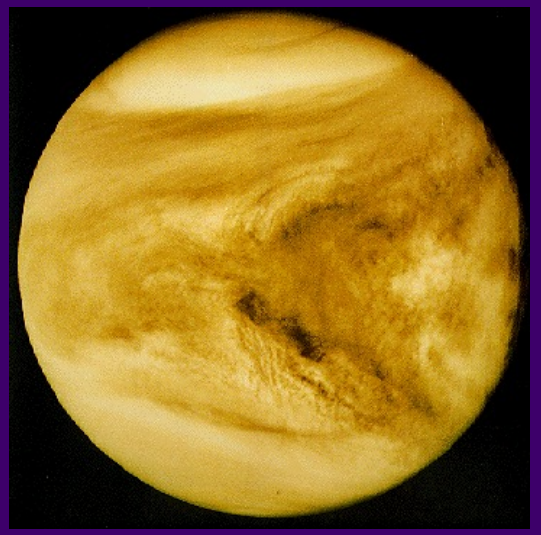
- About 1/3 earth's diameter
- 1/20 earth's mass
- Visited by robotic spacecraft Mariner 10 (3 flybys), 1974
- Another probe, Messenger, is on its way (launched 2004, will fly by in 2008, orbit in 2011)
- Cratered surface, like our moon
- Negligible atmosphere
- 700 K on sunny side



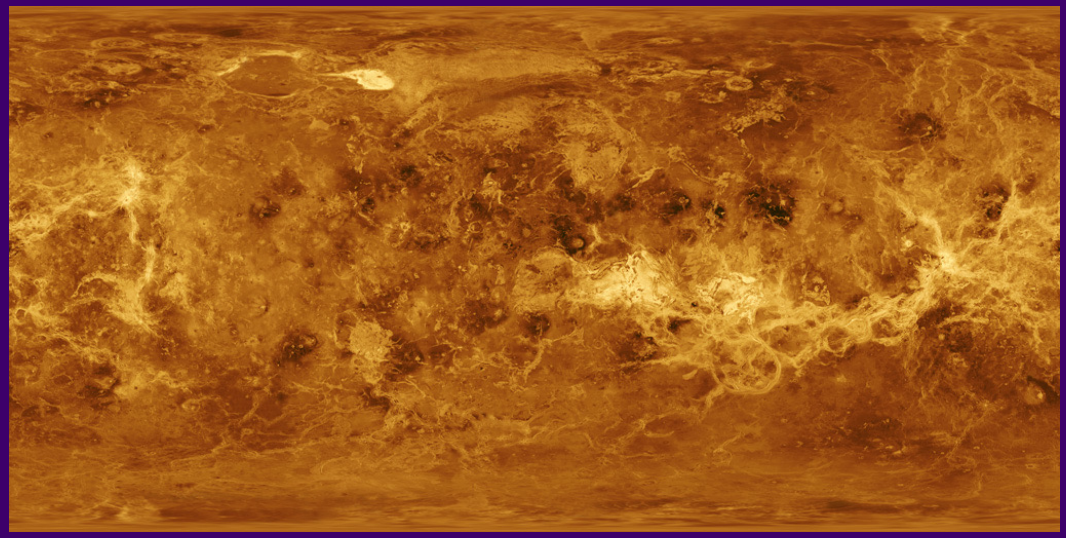
Venus

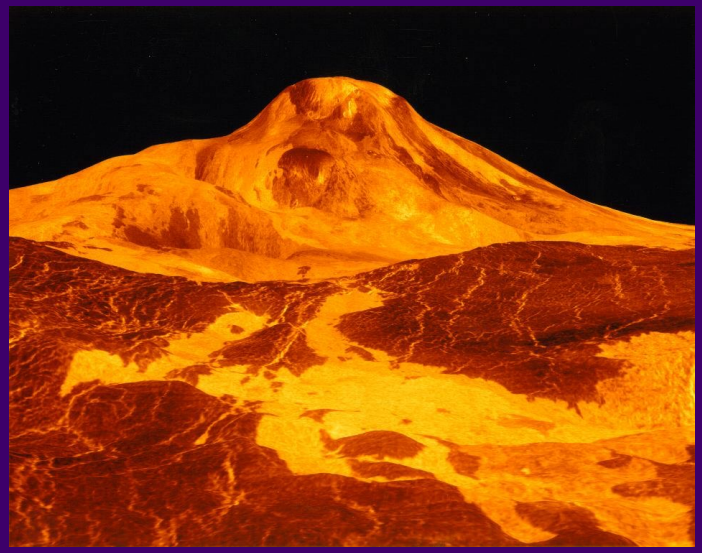
- 95% earth's diameter
- 81% earth's mass
- Covered by opaque clouds, dense atmosphere
- Radar maps show rolling hills, volcanoes
- 750 K average surface temperature(!)
- Visited by several robotic spacecraft: successful Soviet landings 1975-82; US orbiting probe mapped surface with radar in early 1990's.

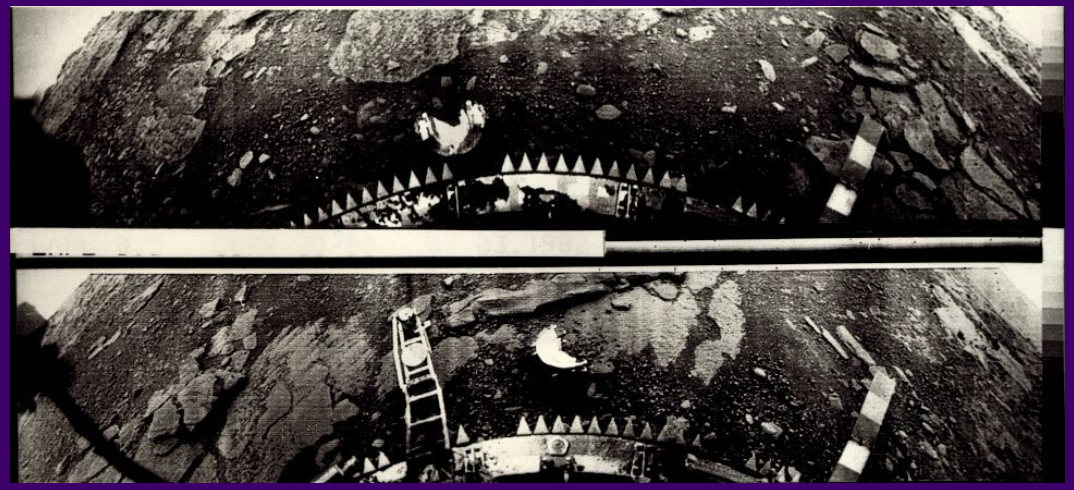




Venus

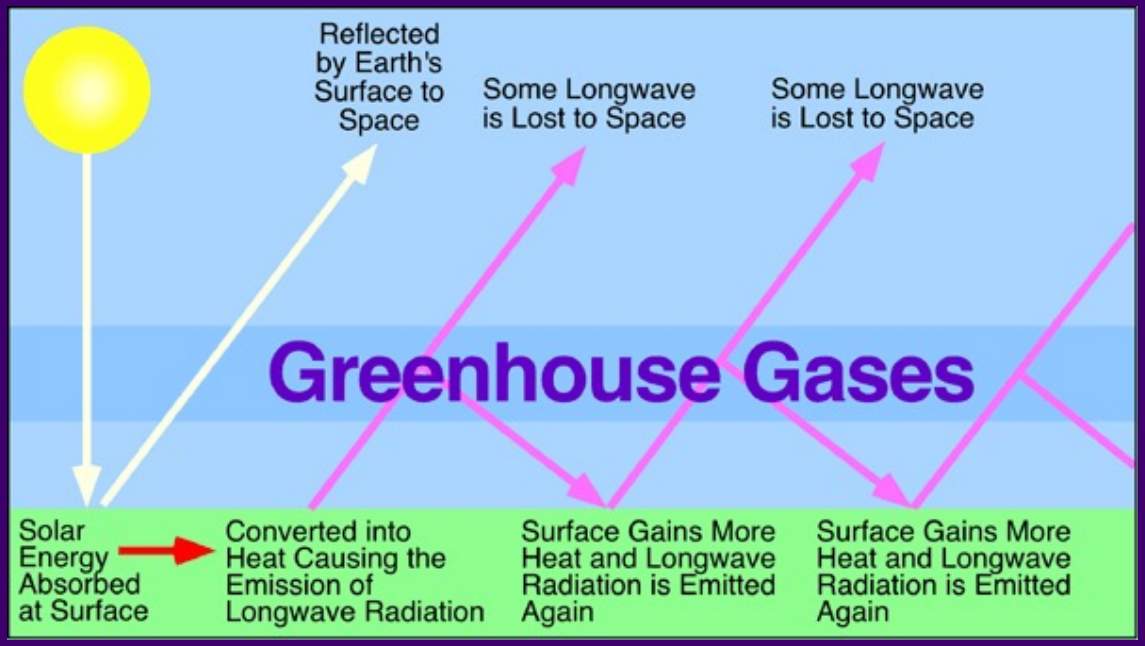






Venus's Atmosphere

- 90 times the pressure of earth's!
- 96% carbon dioxide; rest is mostly nitrogen
- Clouds are sulfuric acid (yum!)
- Carbon dioxide traps the sun's heat: "greenhouse effect"



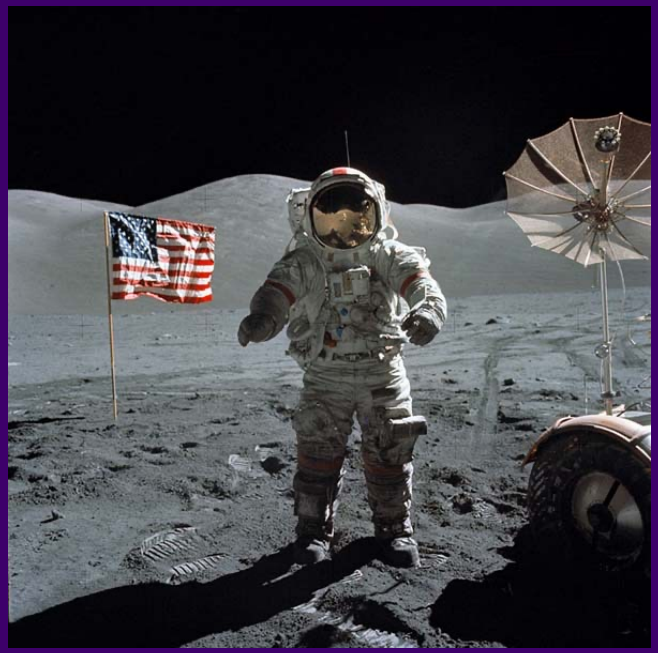
Earth

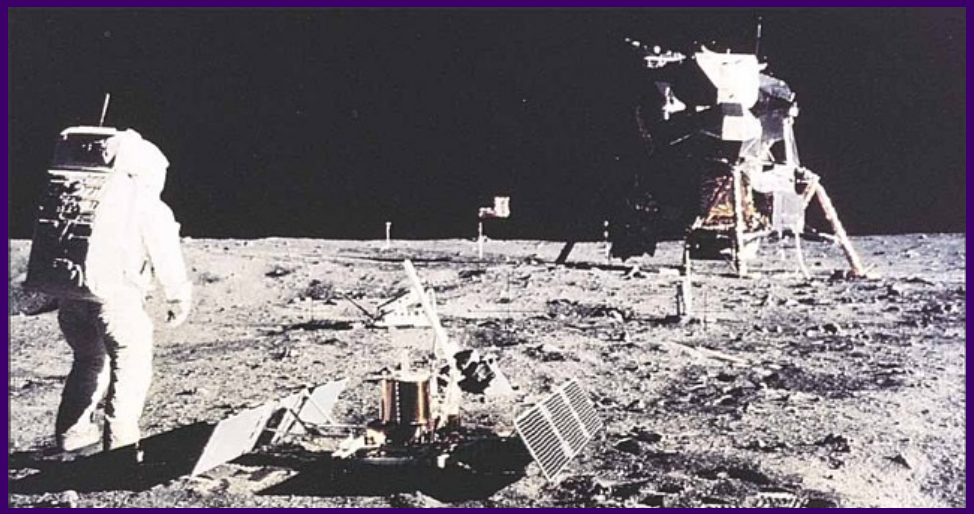
- My favorite planet
- Largest known rock
- Very geologically active
- Atmosphere of nitrogen and oxygen
- 3/4 covered with water
- Nice, comfortable surface temperature
- Only known home of life

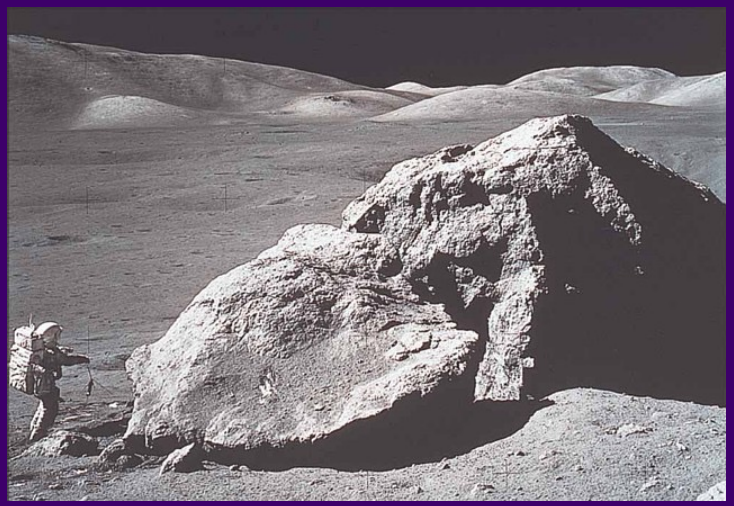
Earth's Moon

- 1/4 earth's diameter
- 1/80 earth's mass
- Covered with craters, ancient lava flows
- Geologically inactive
- No atmosphere
- Essentially no water
- Hot days, cold nights
- Only other world humans have visited (1969-72)

Apollo Moon Landings



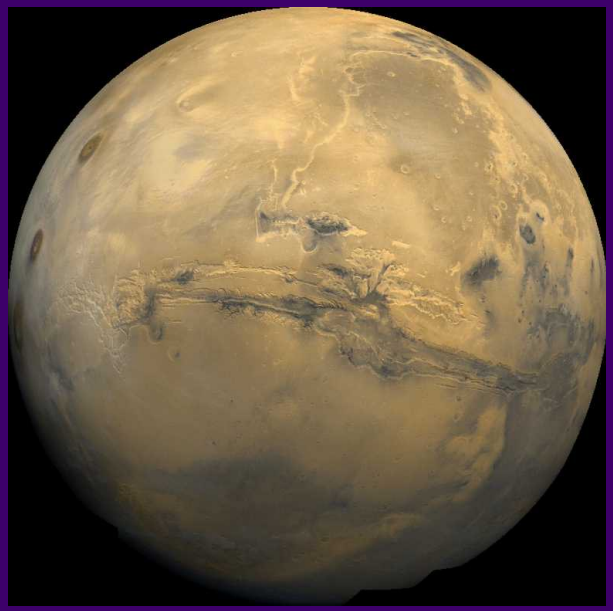




Mars

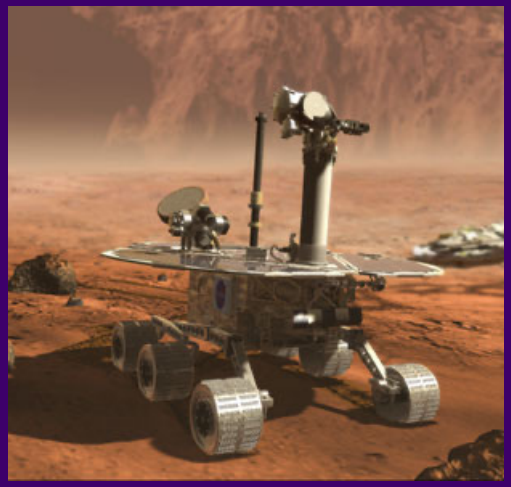
- 1/2 earth's diameter
- 1/10 earth's mass
- Volcanoes, canyons, ice caps
- Very thin atmosphere of carbon dioxide
- No liquid water on surface
- Mostly frigid (200 K), but occasionally warm (290 K)
- Two tiny moons (20 km diameter)

Mars topography and geology



- Some craters
- Huge volcanoes, apparently extinct
- Canyons, channels (from past water?)

Mars landings



2 Viking landers, 1976

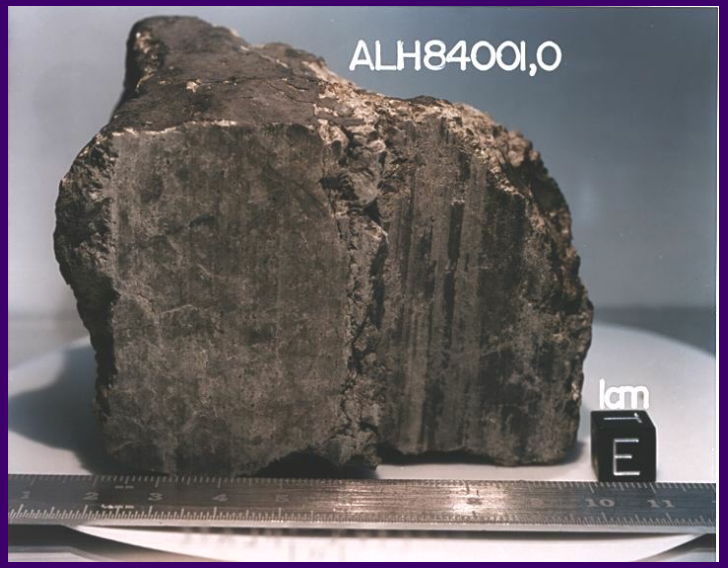
Pathfinder/Sojourner, 1997

Spirit & Opportunity, 2004 (and still working!)

Life on Mars?

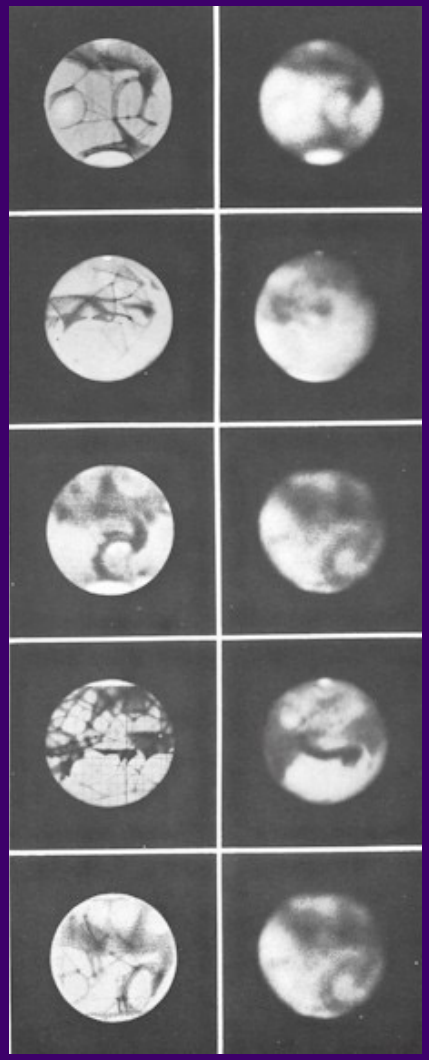
Allen Hills Meteorite, found in Antarctica 1984
Big news story 1996

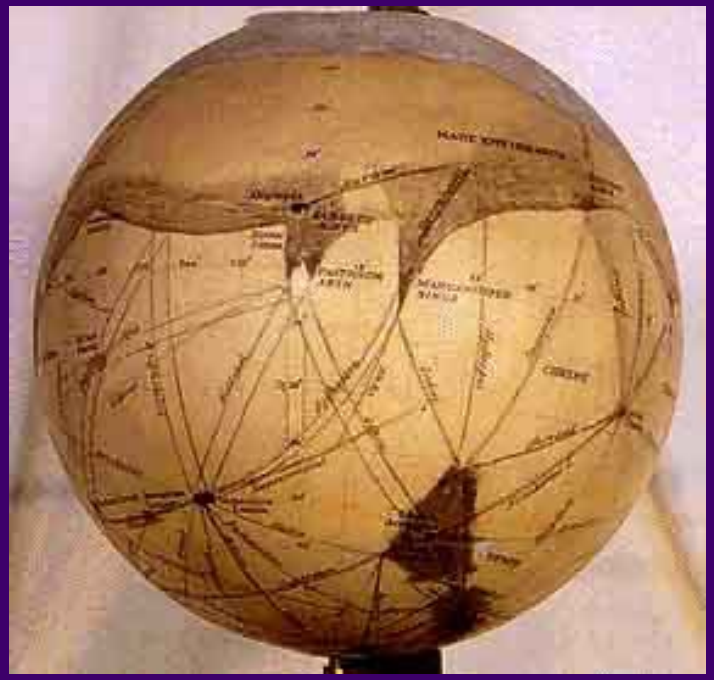
- Definitely from Mars: trapped gases match Mars atmosphere.
- Ejected by meteor impact 15 million years ago, landed in Antarctica 13,000 years ago.
- Contains carbon globules, magnetite, bacteria-like structures. Signs of life on Mars? Most scientists doubt it.



But: Mars was definitely warmer and wetter in the past…

Mars mythology



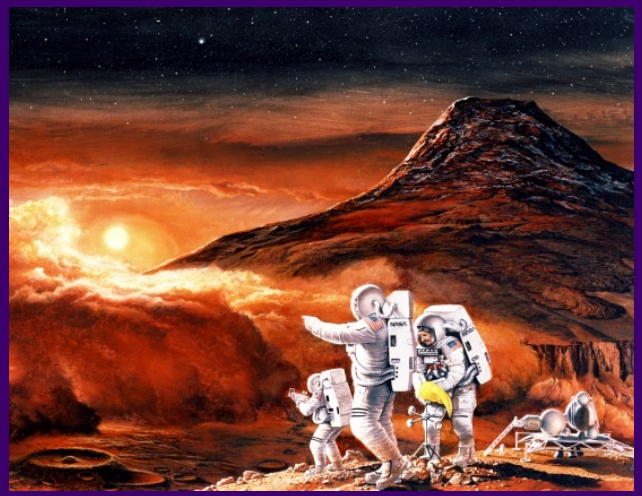


Mars misconceptions

"Mars is essentially in the same orbit... Mars is somewhat the same distance from the Sun, which is very important. We have seen pictures where there are canals, we believe, and water. If there is water, that means there is oxygen. If oxygen, that means we can breathe."

-- Vice President Dan Quayle, 8/11/89

Mars mania



“There are some nuts (and I mean that in the nicest possible way!) who REALLY, REALLY, REALLY want to go to Mars. I mean REALLY. You can find out about them at, for example, The Mars Society . They even have a station in the Utah desert! Crazy nuts. I love them. We'd never get anything done if it wasn't for nutty nuts!”

-- Dr. Stacy Palen

The Terrestrial Planets