# Announcements


- I didn't get all the tests graded, sorry! I'll be able to hand back and talk about them on Friday
- WebWorK due on Friday
- Polling: `rembold-class.ddns.net`

# The Sky Tonight + APOD

- ISS crossings tonight at 7:14 and 8:51 to the NW
- Iridium Flare at 7:57:22. Altitude: 54° to the SE
- Moon at last quarter phase

# Review Question

Which of the following is not one of the large forces that can shape the terrain of a planet?

A. Cratering
B. Volcanos
C. Temperature
D. Tectonics

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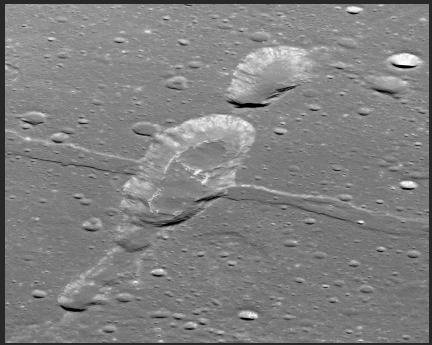
# Crater Layers

- Ordering of features on top of one another can tell us which came first
- Useful for dating craters or deciding when a nearby volcano was active
- Since cratering rates are roughly constant, counting craters is generaly a good indicator of the age of a surface



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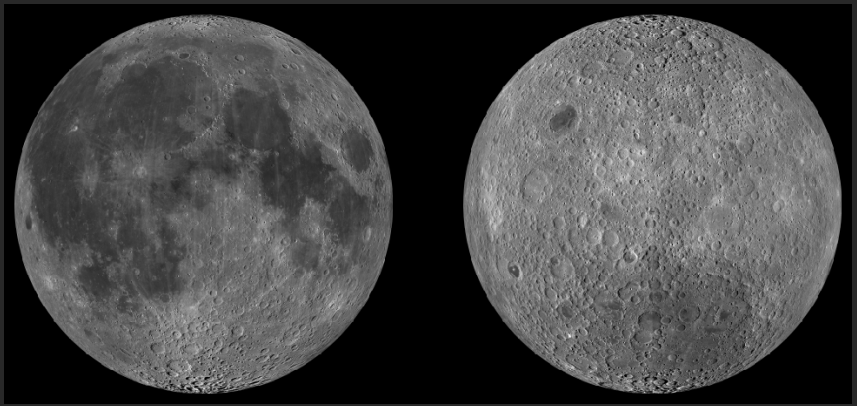
# Lunar Features

- About a quarter the size of Earth
- About 60% as dense
- Heavily Cratered
- Has Highlands and Lowlands (Mare)
- Rotation tidally locked
- No magnetic field
- No atmosphere
- Features named after scientists

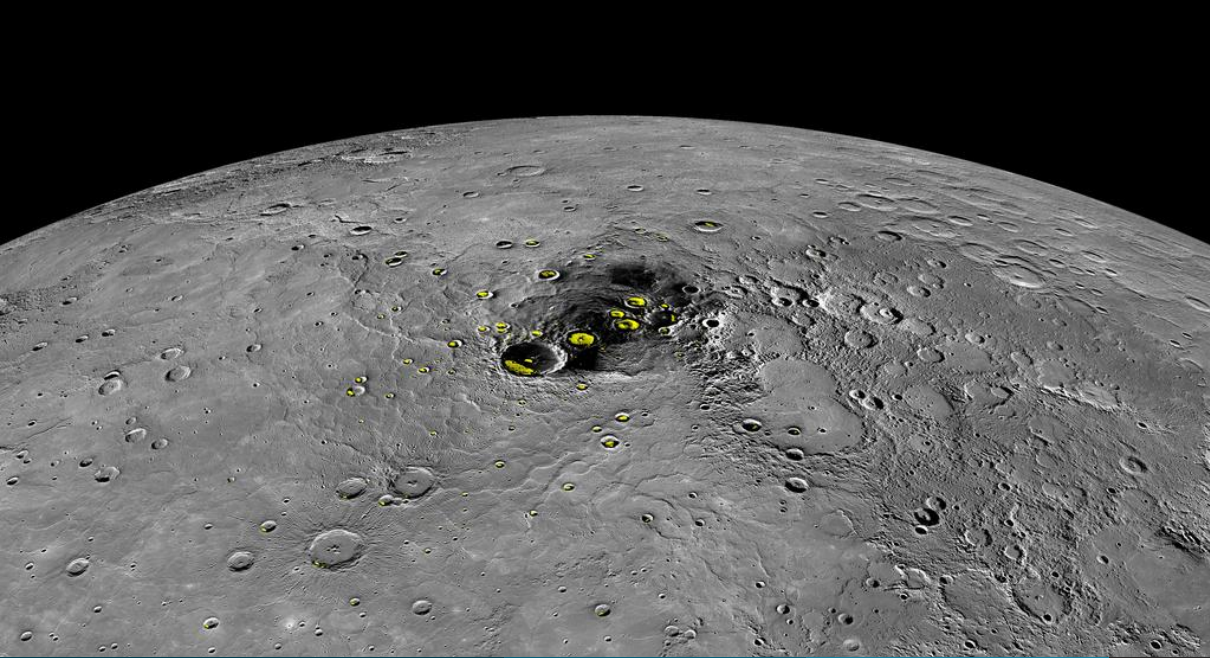
# Lunar Composition

- Largely formed of similar rocks to the Earths crust and upper mantle
- Lacking in heavier metals (hence the lower density)
- Near side has lots of lowlands, whereas far side full of craters

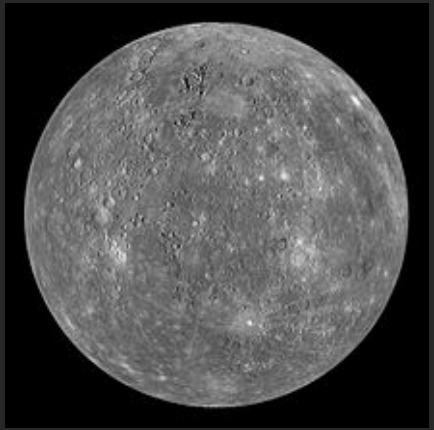


# Lunar Formation

- Currently thought to be the result of a gigantic impact
- Mars sized object had a grazing impact with Earth
- Flung mostly outer layers of rock into space (hence composition)
- Hot Earth kept the near side warmer, causing more rock to condense on the far side
- Far side thicker means harder to rupture and cause lava flows



# Mercury Facts



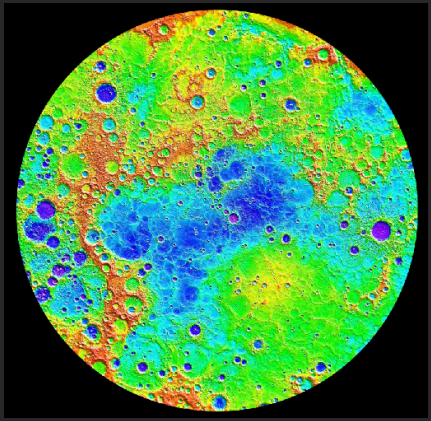
- Smallest planet
- Very thick core
- Heavily cratered
- Most elliptical
- 2:3 tidally locked
  - 3 days every two years!
- Extreme temperature swings
- Features named after artists!

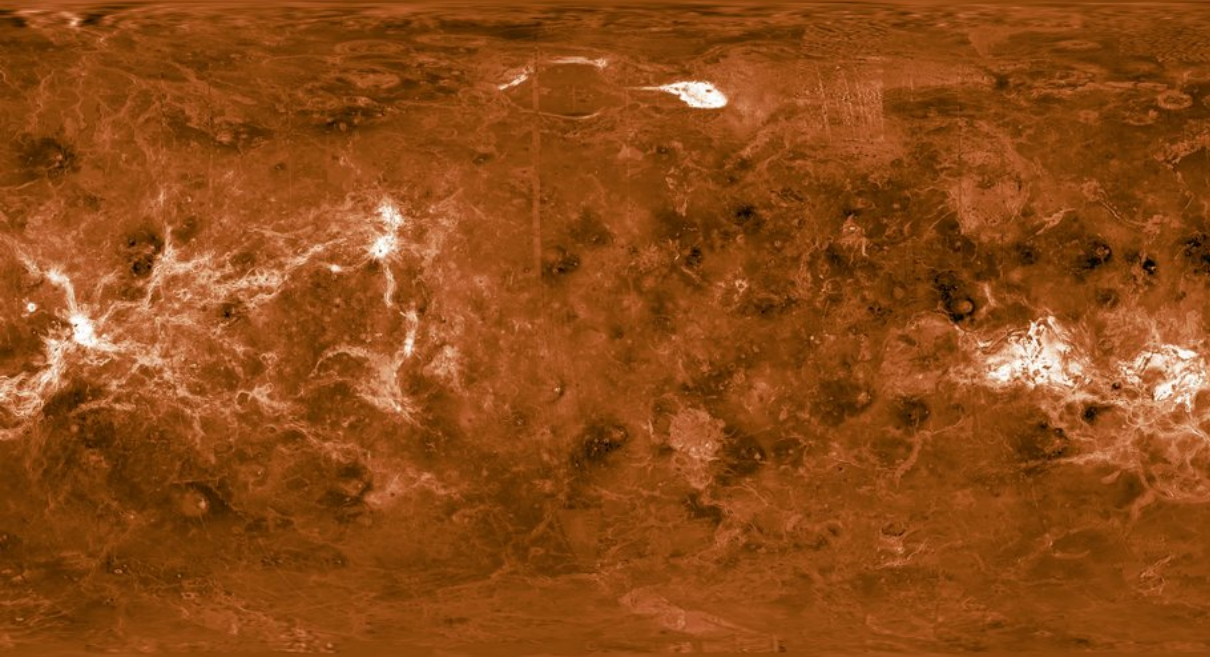
# Rotation


- Too small to see craters for a long time
- Astronomers assumed it was 1:1 locked like the Moon to Earth
- Radar doppler showed it had a different pattern!
- Days last about 59 Earth days, years last about 88 Earth days
- Makes for some exceedingly bizarre situations

# Terrain Features

- Heavily cratered
- No evidence of tectonics
- Some volcanic activity in the past, but none now
- Crust cracked under shrinkage as planet cooled





# Venus Facts

- Few craters, and evenly spread across surface
- Lots of geologic activity in volcanos
- Few signs of erosion
- Rotates VERY slowly (and backwards!)
- Closest to Earth in size and density
- Terrain features named after female gods and heros

# Modest Venus

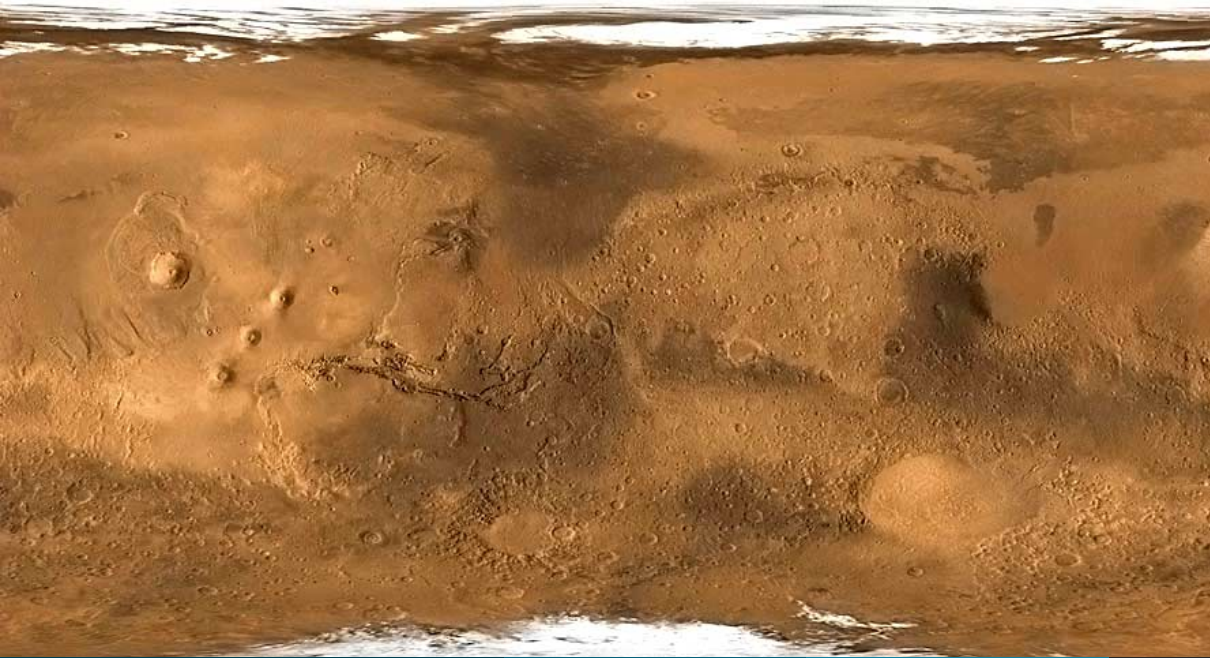

- Dense clouds made it difficult to map the surface of Venus
- Also meant it was difficult to predict rotation rate
- Need cloud penetrating radar maps to peer through
- Clouds also serve to drive a POWERFUL greenhouse effect

# A bit of refinishing

- Venus has comparatively few craters
- Implies an active geology
- What craters there are look relatively fresh
  - Not much erosion
- Volcanos primarily responsible for refinishing the surface
- Potential that on long time spans almost the entire planet erupts and smoothes the entire surface!

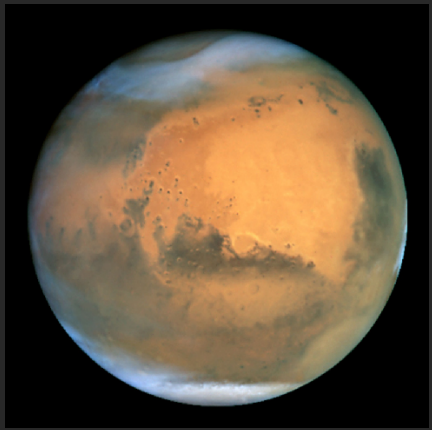
# Venus: Too Hot to Handle


- Atmosphere predominantly carbon dioxide
  - Also makes the atmosphere HEAVY, 90x Earths
- Product of a runaway greenhouse effect
  - Sun evaporated water
  - Water vapor greenhouse heated to where $CO_2$ disolved out of rocks
  - $CO_2$ greenhouse boiled away any water left, which in turn released more $CO_2$...
  - Temperature now a lovely 800°F
- Sulfuric Acid rain (evaporated before hitting surface)



# Mars Facts

- Half the size of Earth
- About 70% as dense
- Red colored due to rust dust
- LARGE terrain features
- Evidence of past liquid
- Has a thin atmosphere



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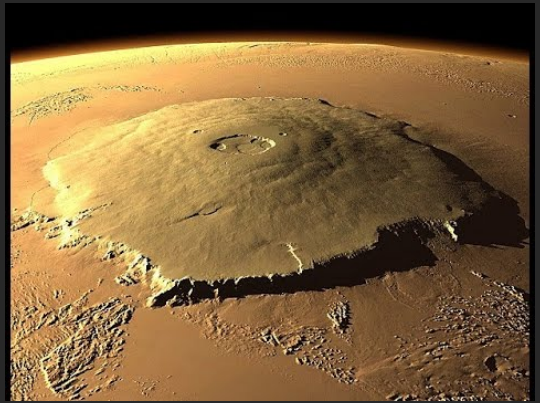

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- HUGE volcanos
- Evidence of plate tectonics
  - Valles Marineris
- Lots of craters, in certain areas
  - A strong, then weak atmosphere?

# The Case of the Disappearing Atmosphere


- Had flowing water in the past, so needed to be warmer
- Thus likely had a thicker atmosphere
- Where did it go?
  - Smaller planet leaks atmosphere faster
  - Weak magnetic field leaves atmosphere vulnerable to solar wind
  - Less greenhouse means lower temperatures, until water vapor froze out of the atmosphere
  - Results in a sort of runaway refridgeration effect

# Understanding Check

Given the image of Archimedes crater to the right, which event would you say happened LAST?

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