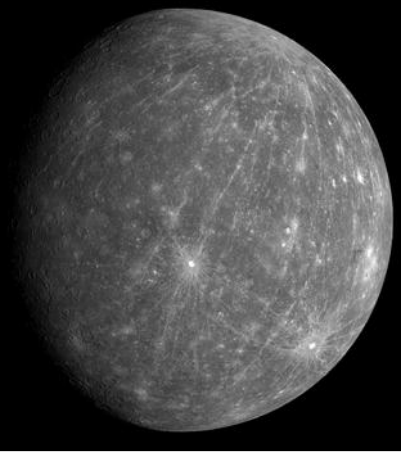
Mercury



Basic information

Density (avg): 5.4 g/cm^3

Distance from Sun (avg): 0.387 AU

Orbital Period: 88 days

Rotation Period: 58.7 days

Albedo: 0.09

Moons: 0

Atmosphere: *trace*

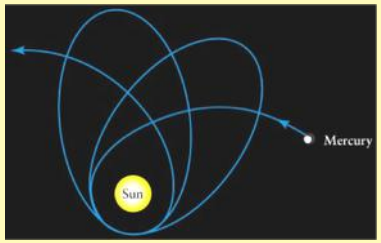
Tilt of rotational axis: 0º

Mercury *"Messenger of the Gods"*

• named after *Roman God* known for *speed*

• it is (now) the *smallest* planet

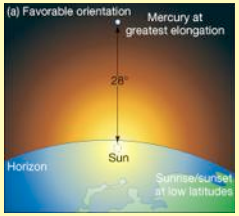
• precession of its ***elliptical*** orbit *provided evidence for* ***Einstein's*** *General Relativity*

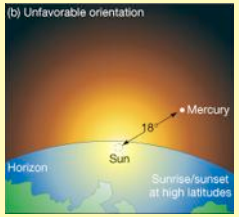


Observing Mercury

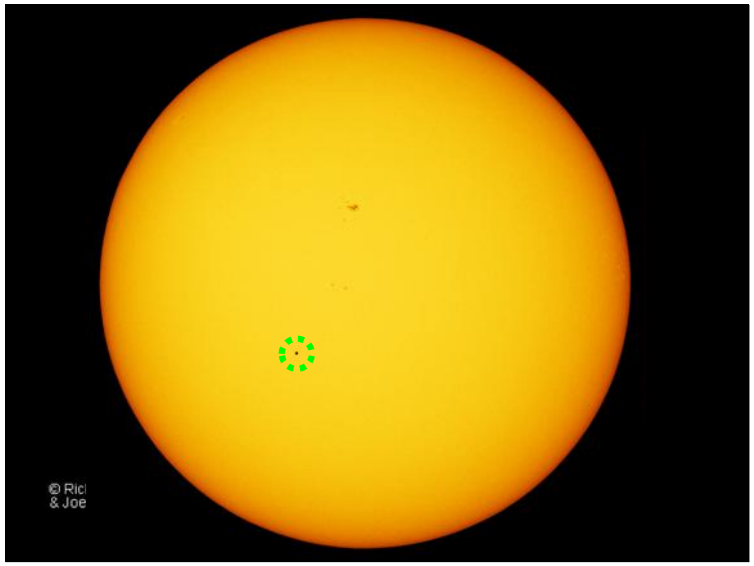
• images of *phases* on ***Mercury*** from ***Earth***

Q: Why is Mercury ***difficult*** to view from Earth?





• it's ***small***, ***dark*** and *very close to* ***Sun***

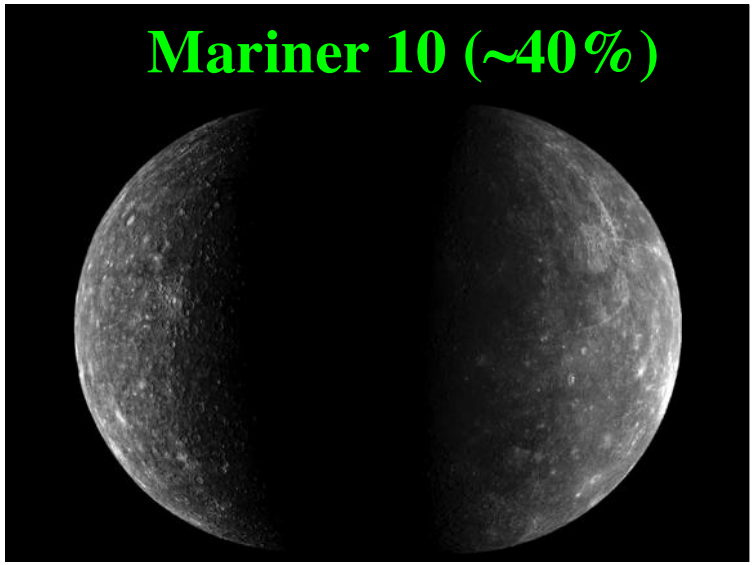


Exploring Mercury

- ***Mariner 10*** *flybys (1974-75)* *NASA*

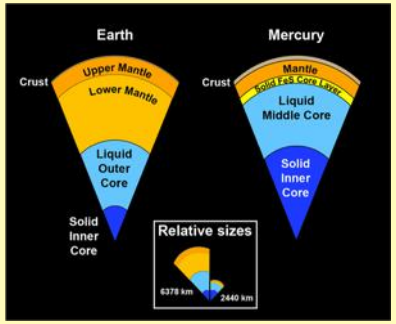
- ***Messenger*** *orbiter (2011-2015)* *NASA*
  MErcury Surface, SpaceENvironment, GEochemistry & Ranging
- *global resolution* of *~250m* (at spots down to *20m*)

- ***BepiColombo*** *orbiter, (2025 - ?)* *ESA/JAXA*
- two satellites launched together: *Mercury Planetary Orbiter (MPO) and Mercury Magnetospheric Orbiter (MMO/Mio)*

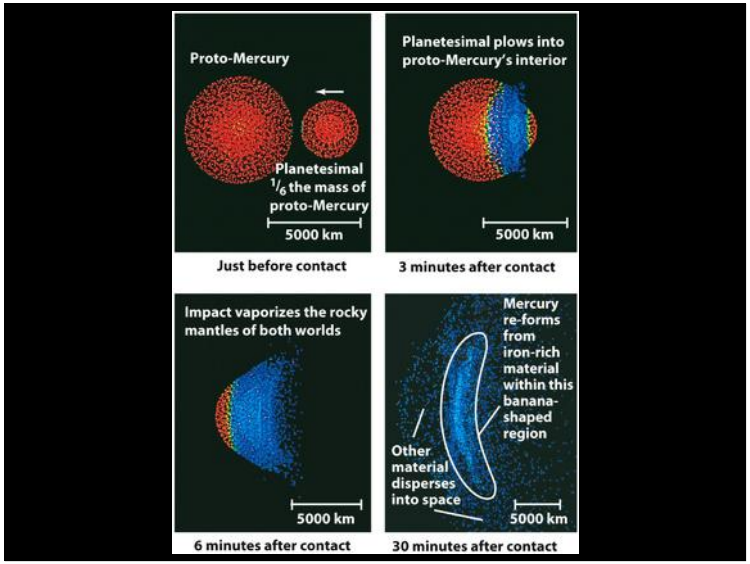


Interior Structure

- ***density*** is *very high* for ***Mercury's*** size
- *"uncompressed" interior* contains *>% iron* than ***Earth***
- maybe a *Moon-sized* object *collided* with proto-***Mercury?***

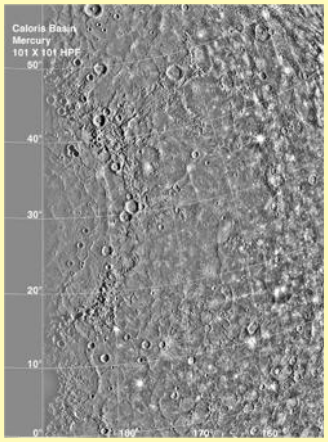


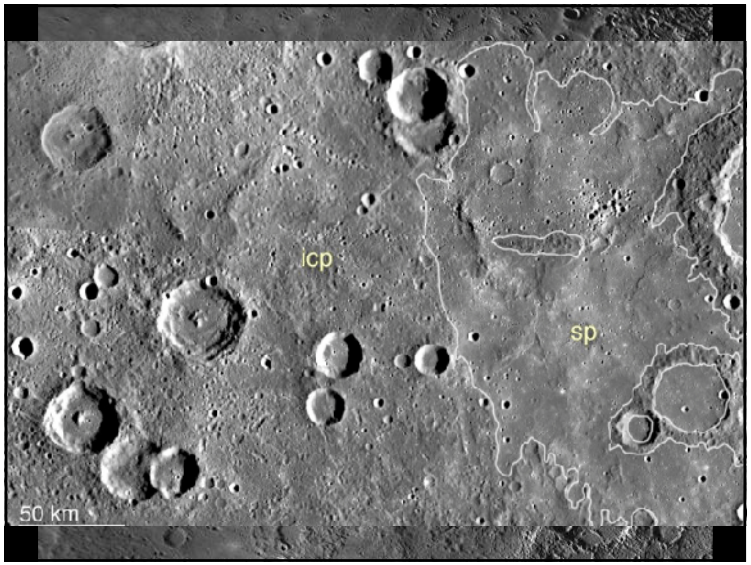
- *light material* ***vaporized***; *2 cores combined*



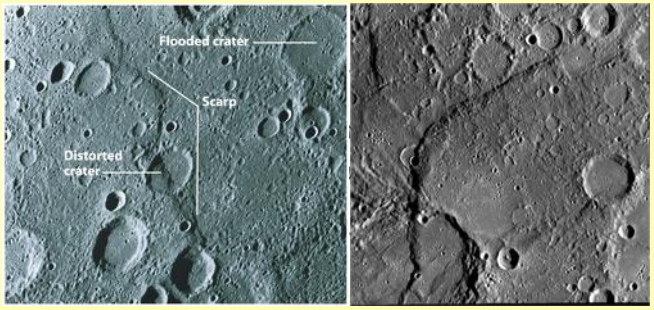
Surface Features

- ***plains*** dominate much of Mercury's surface
- ***inter-crater plains***
  - older, HBP
  - between larger craters
  - craters of all sizes
  - origin? still unclear
- ***smooth (volcanic) plains***
  - younger, LHBP
  - "like" Maria; fill craters





• ***scarps***: ~ 3 km high *cliffs* formed as the planet *cooled & contracted* (*crust wrinkled – like fruit*)



• indicates *lack of molten material* near surface when scarps formed - *relatively late, outer portion cooled*

Mercury vs. Moon

Q: List some visual differences between the two…

Temperature

• "*Daytime*" temp: 623 K (350 ºC) – *melt lead!*

• "*Nighttime*" temp: 103 K (-170 ºC)

Q: *Why such an extreme temperature difference?*

• *very slow rotation*
• *no atmosphere* to *moderate* temperatures

Mercury's Atmosphere

• atmospheric pressure: ~10^{-14} bars ***very low!!***
(***1 bar*** is pressure @ *sea level on Earth*)

• *poorly known* & *constrained*:
-**H**, **He** from ***solar wind***
- ***variable*** amounts of **Na**, **K**, **Ca; O?**

• ***solar wind*** knocks atoms off surface (***sputtering***)

Magnetic Field

Q: *Do we* ***expect*** *Mercury to have a magnetic field?*

• *strength ~1%* of ***Earth's*** *magnetic field*

Q: *Why is magnetic field* ***so weak****?*

• *has a (liquid) iron core* but ***very slow rotation***