



# Astronomy

with your host:

**Lecture 7: The  
Moon and Mercury**



Coop

The

Moon



$$m \sim 7e22 \text{ kg} \sim 1/80 m_e$$

$$r \sim 1738 \text{ km} \sim 1/4 r_e \sim 6 \text{ ms}$$

earth moon distance: 400,000 km  $\sim 1.3$  seconds

NO ATMOSPHERE

# The Moon and Mercury: Ch 8

## Surface Temperature

Day: 400 K

Night: 100 K

# The Moon and Mercury: Ch 8

Why no atmosphere?

Average Molecular Speed

average molecular speed (in km/s)

$$= 0.157 \sqrt{\frac{\text{gas temperature (K)}}{\text{molecular mass (hydrogen atom masses)}}}.$$

# The Moon and Mercury: Ch 8

## Escape Speed

escape speed (in km/s)

$$= 11.2 \sqrt{\frac{\text{mass of body (in Earth masses)}}{\text{radius of body (in Earth radii)}}}.$$

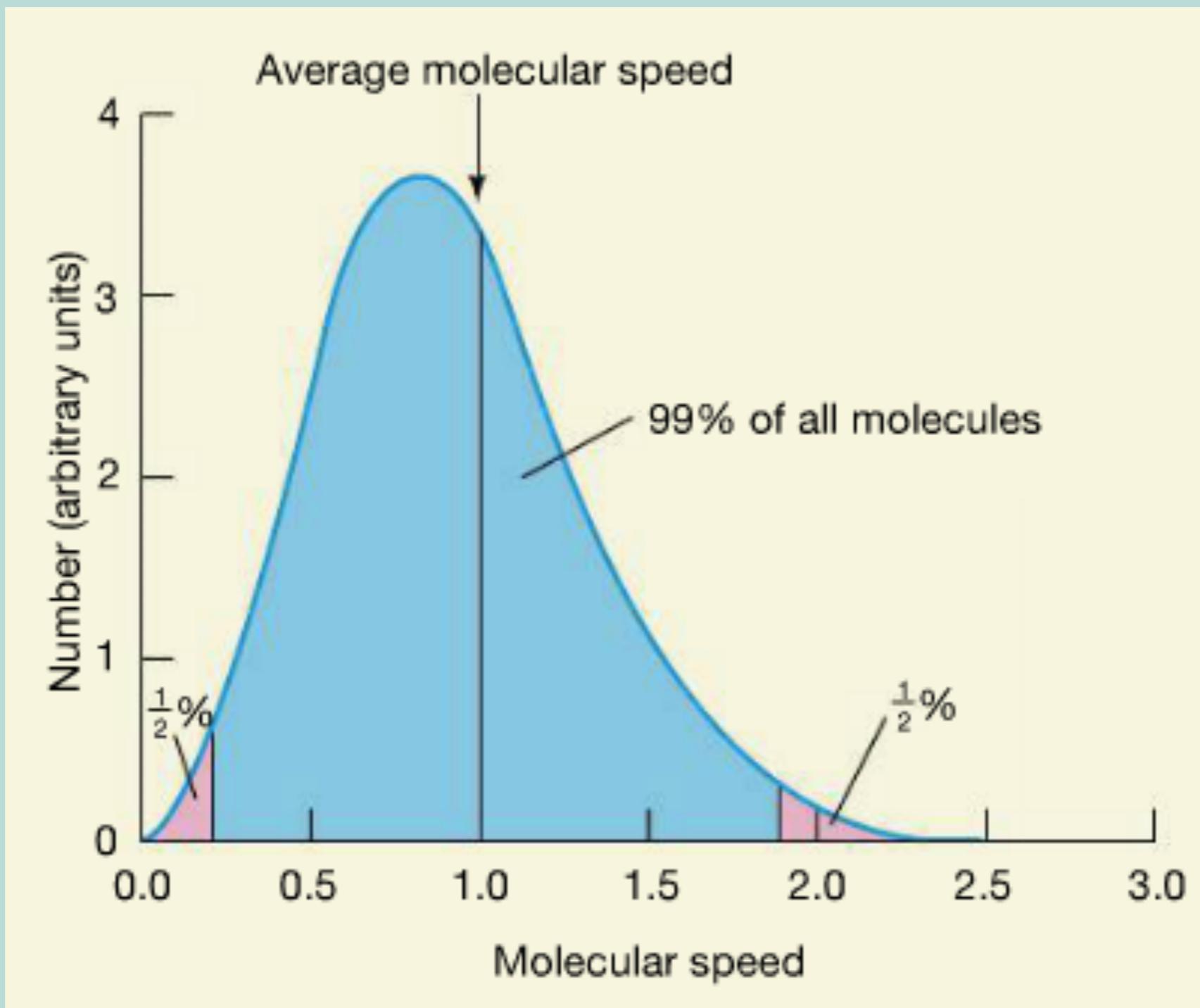
# The Moon and Mercury: Ch 8

## Escape Velocity

Earth: 11.2 km/s

Mercury: 4.2 km/s

Moon: 2.4 km/s



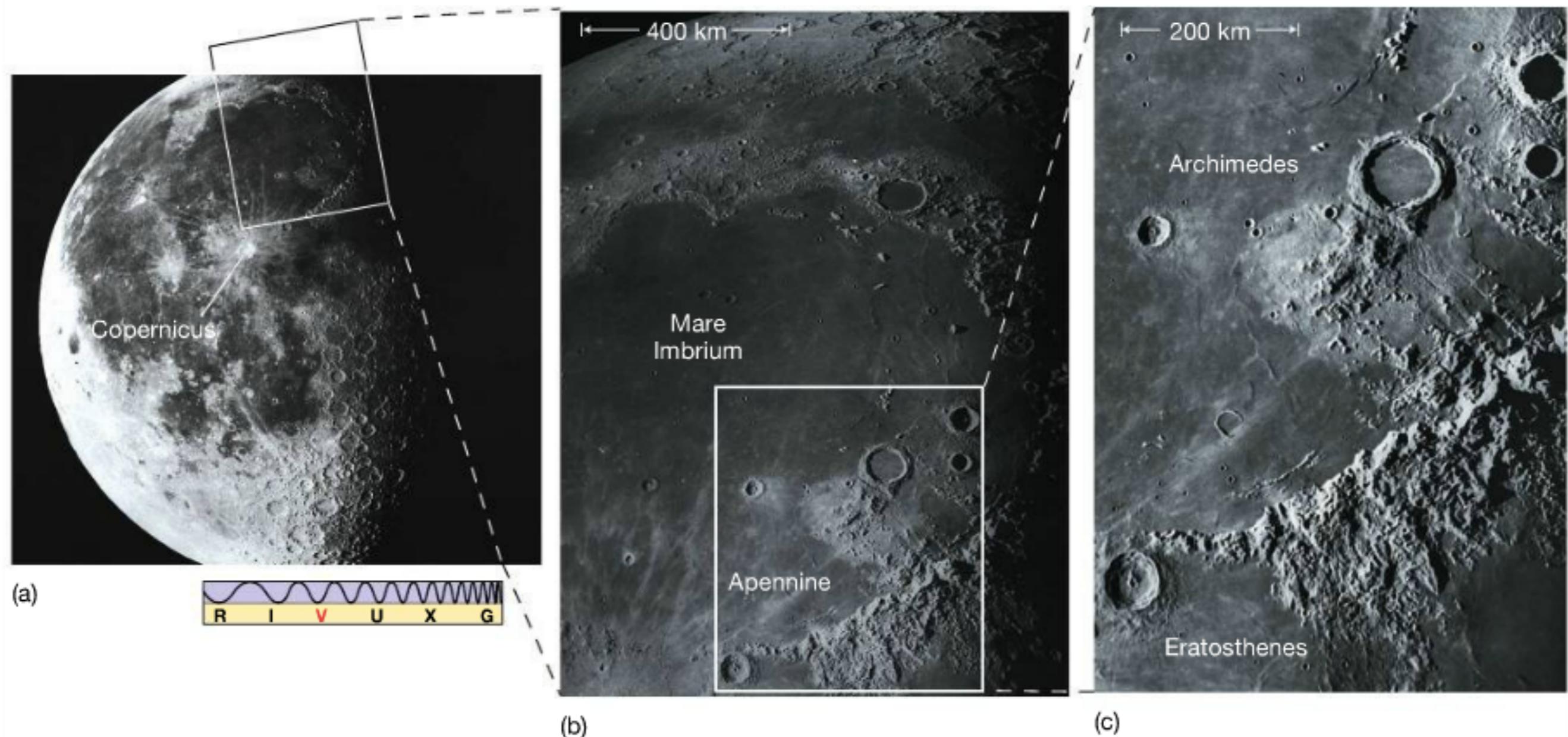
Rule of thumb: 6 times average speed.

# The Moon and Mercury: Ch 8

## Lunar Map

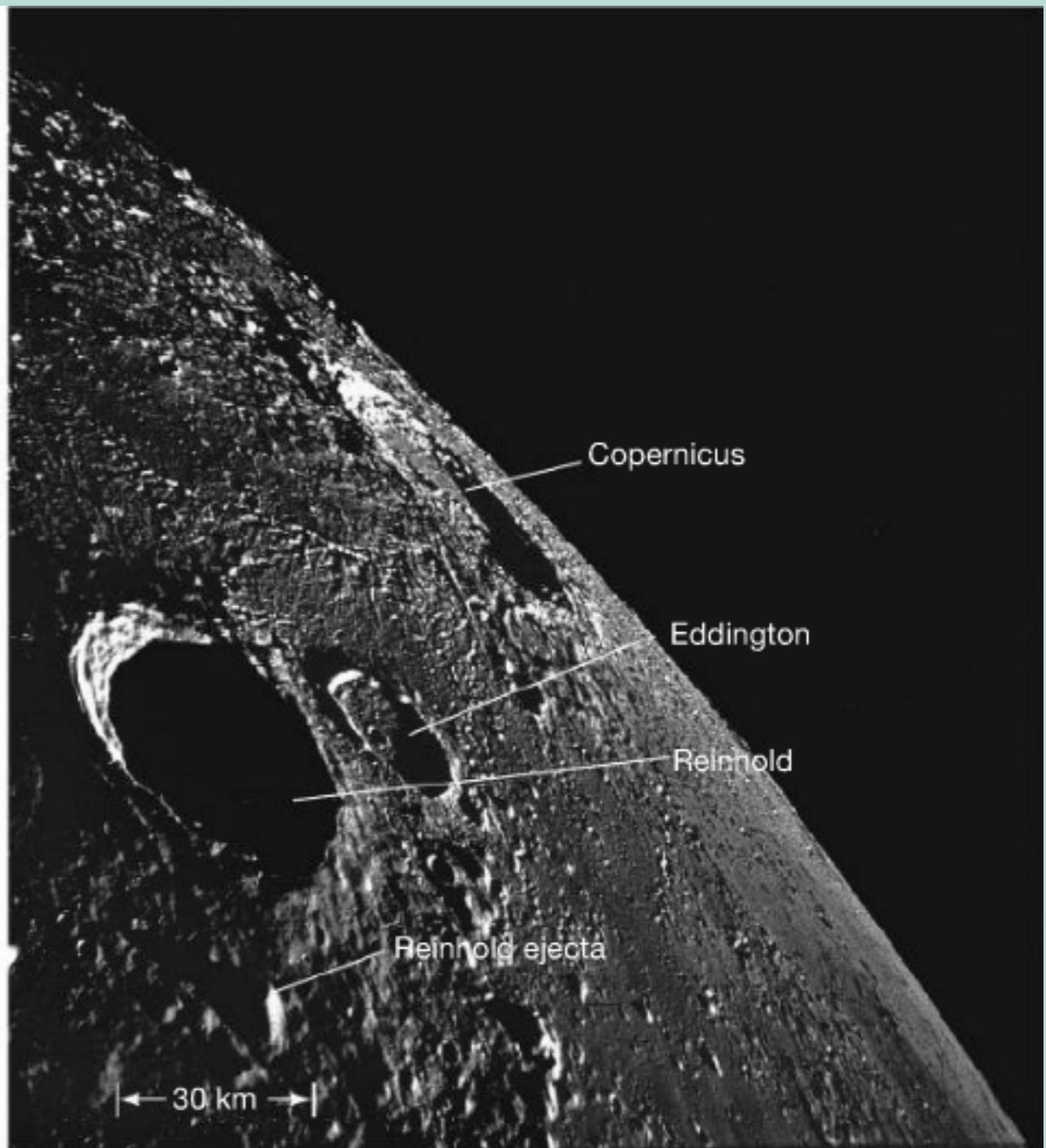
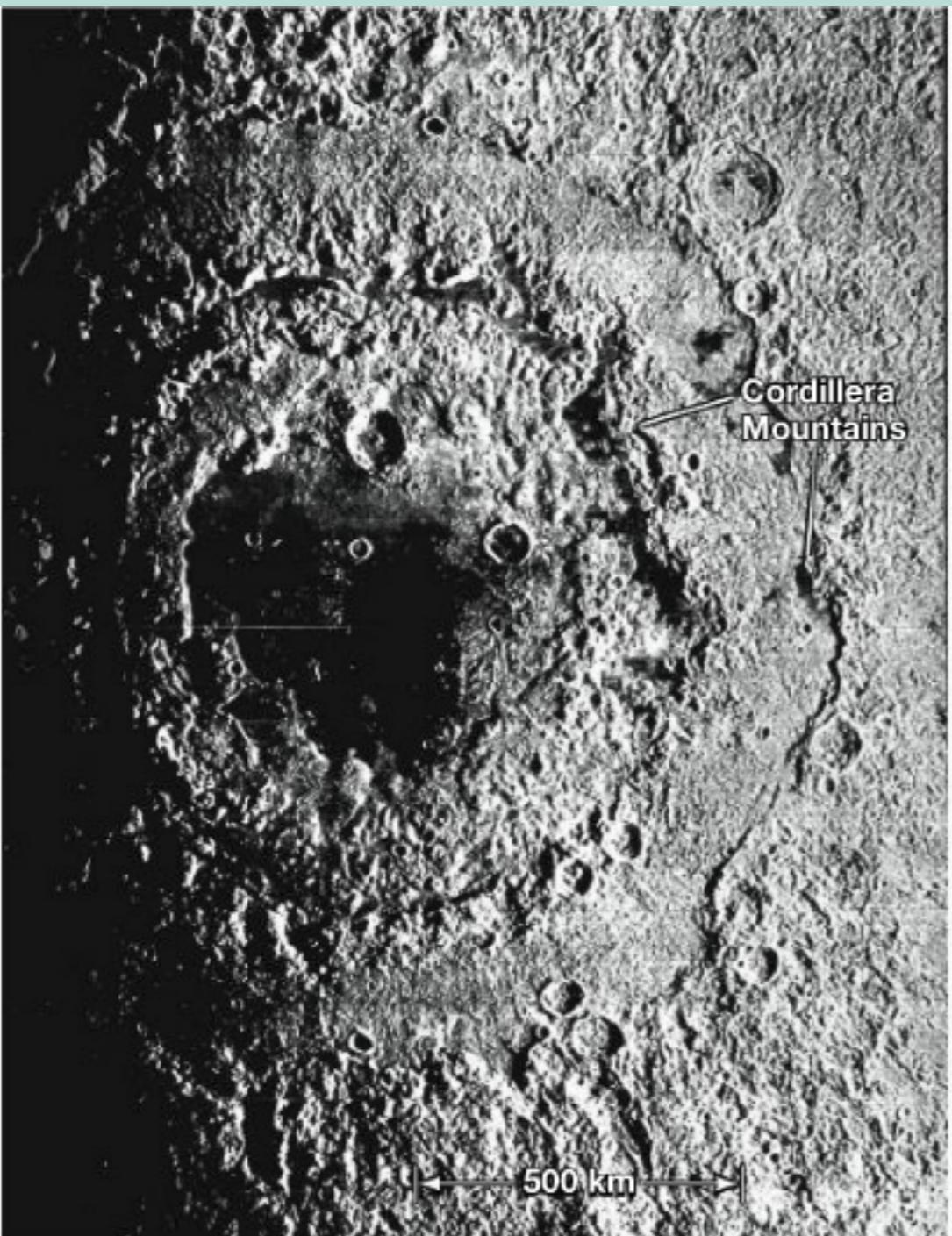


# The Moon and Mercury: Ch 8



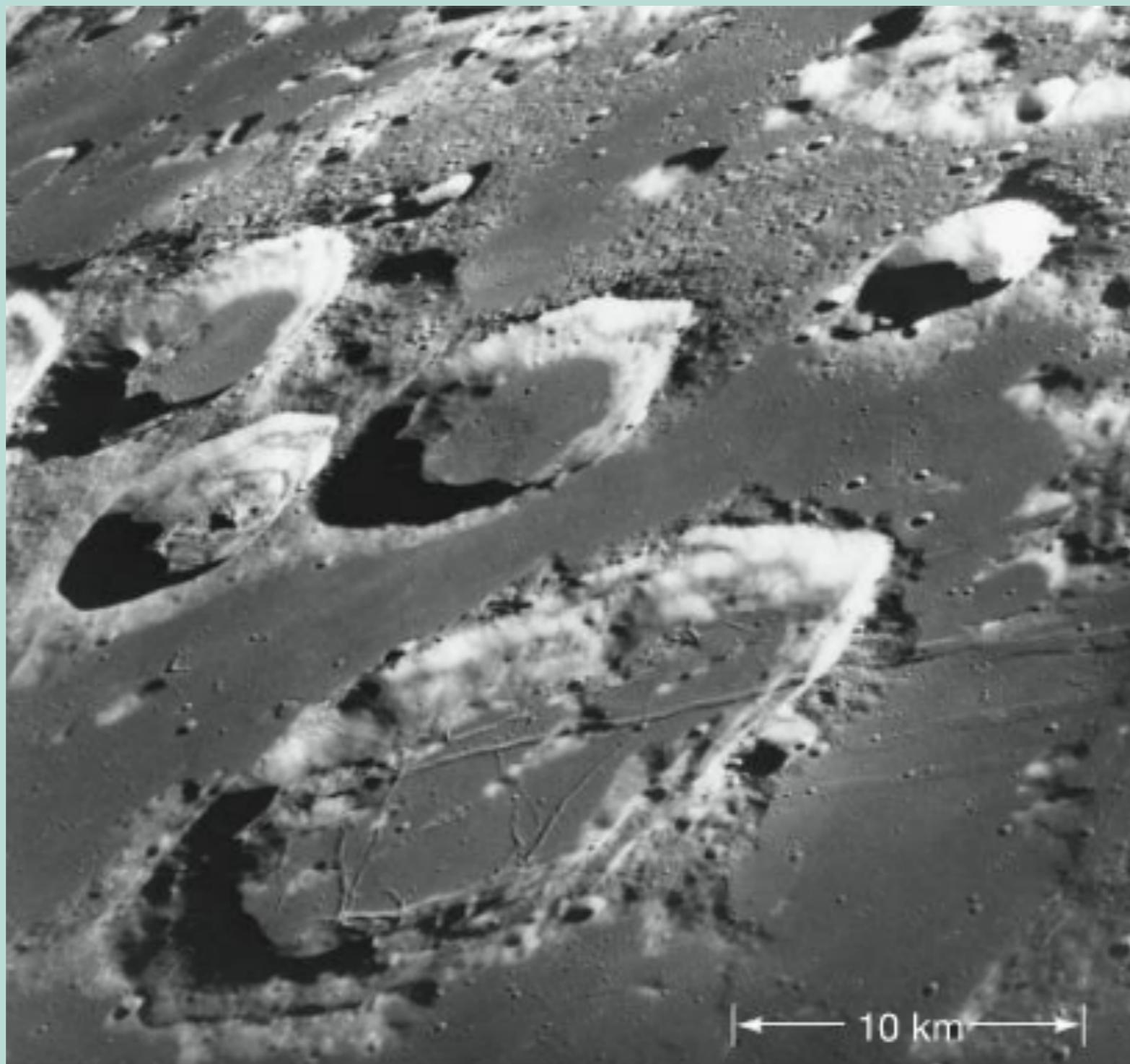
Maria are higher density!

# The Moon and Mercury: Ch 8



# The Moon and Mercury: Ch 8

## Lunar fly-by images



# The Moon and Mercury: Ch 8

## Moon Cruisin'



# The Moon and Mercury: Ch 8

## Regolith



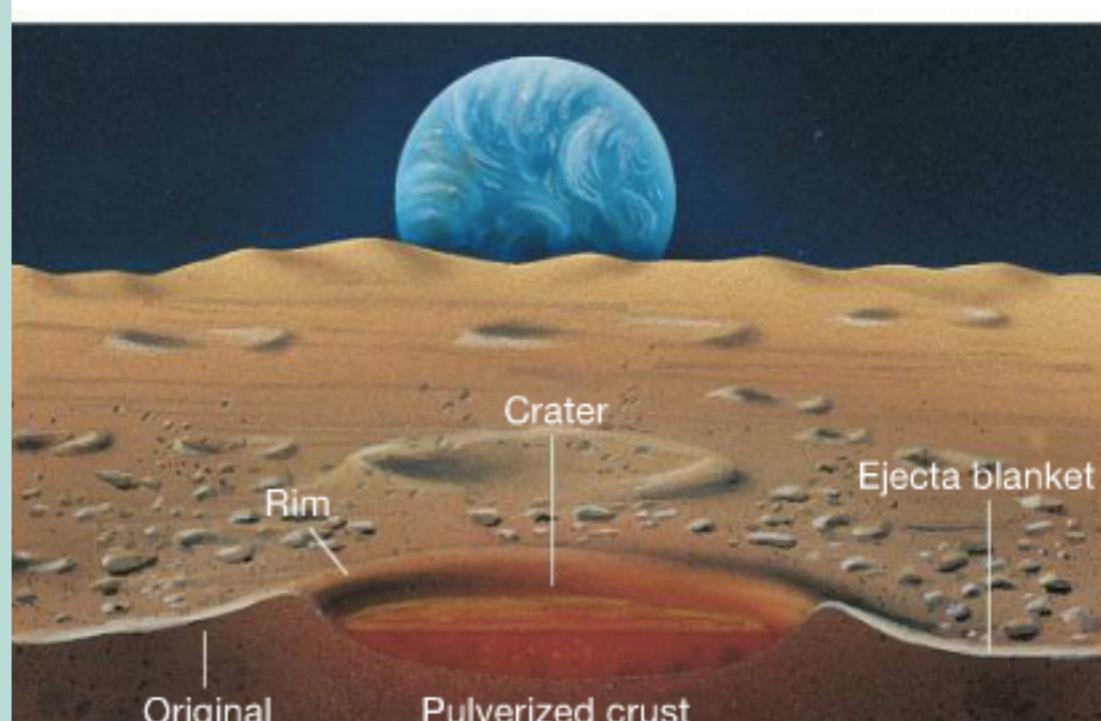
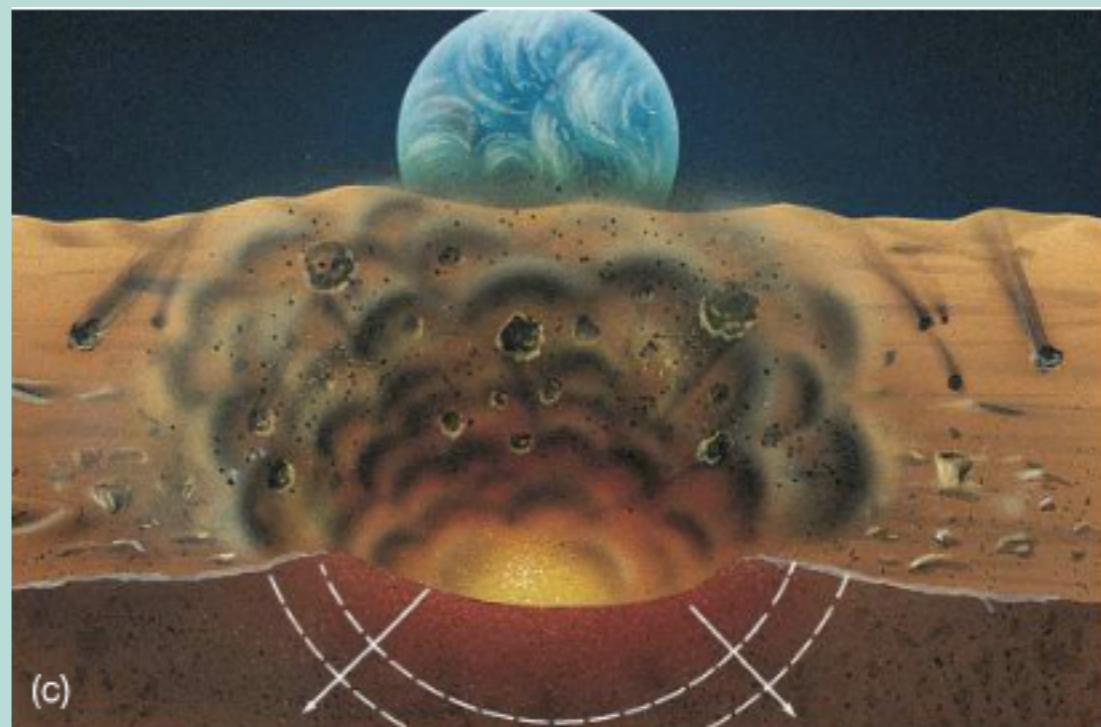
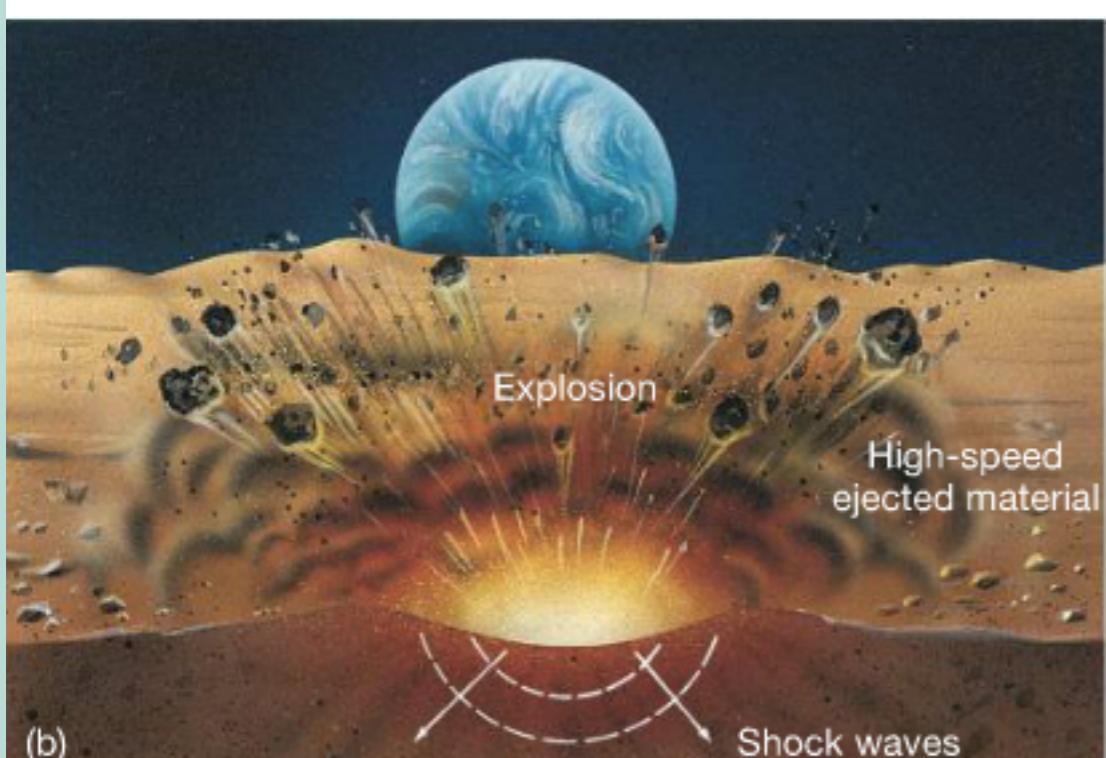
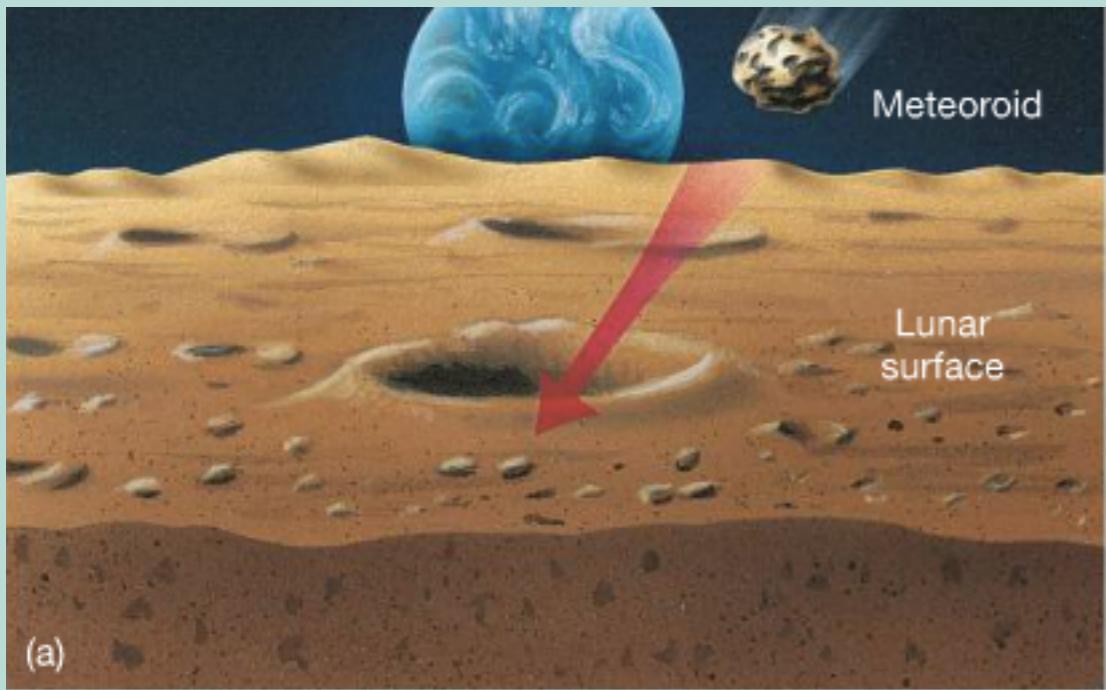
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USA! USA! USA!



# The Moon and Mercury: Ch 8

## Crater Formation



1 kg moving at 10 km/s = 10 kg TNT

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## Barringer Crater



45 meter rock

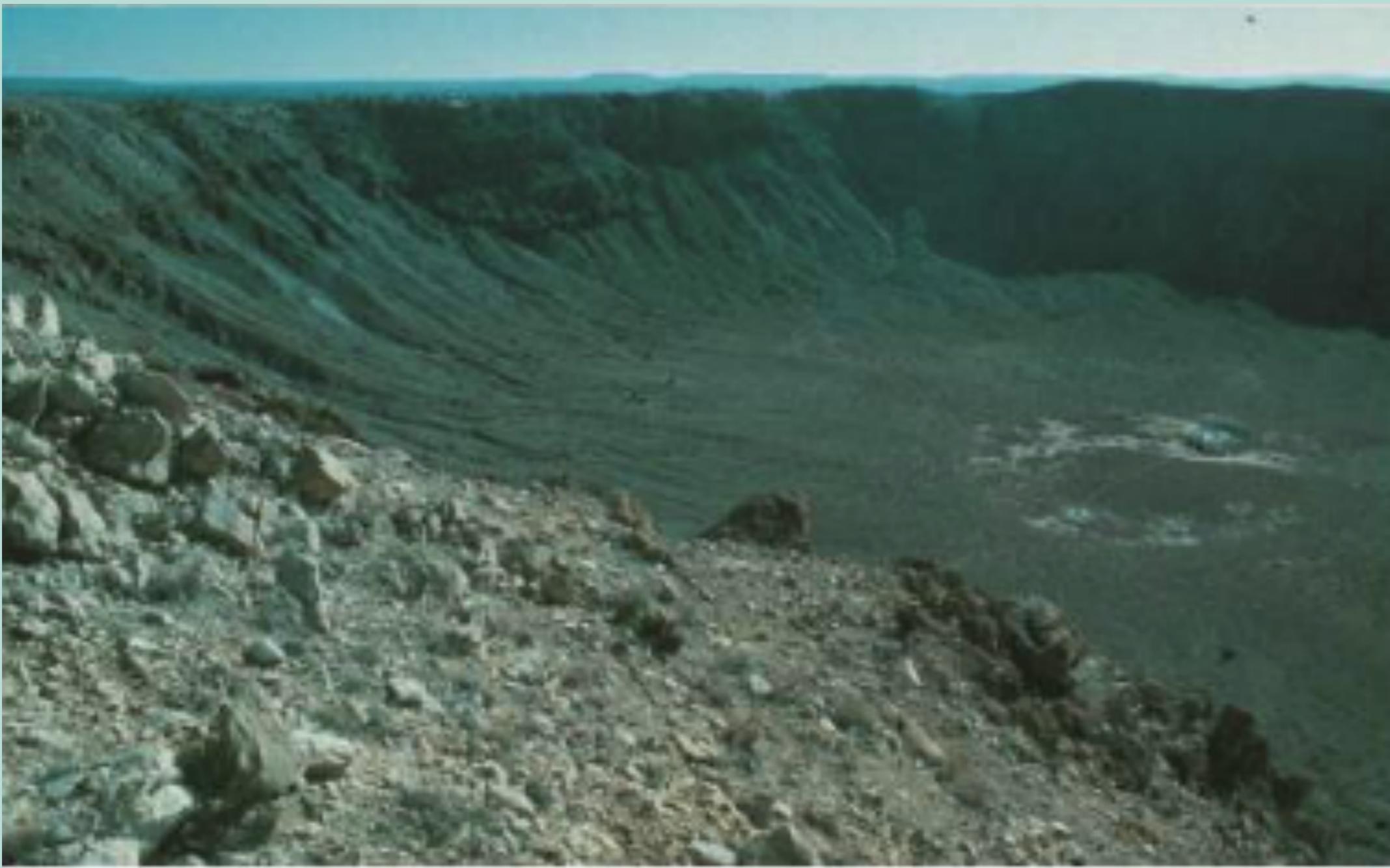
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**For the sake of perspective...**



# The Moon and Mercury: Ch 8

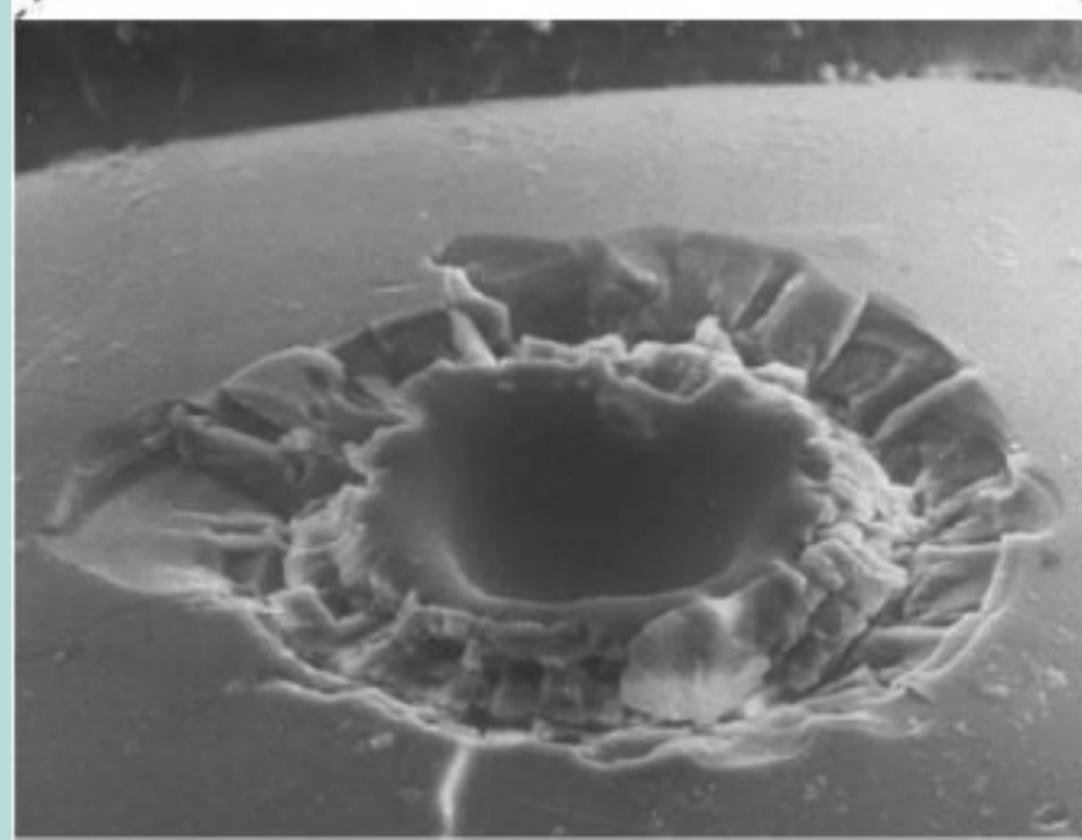
## Barringer Erosion





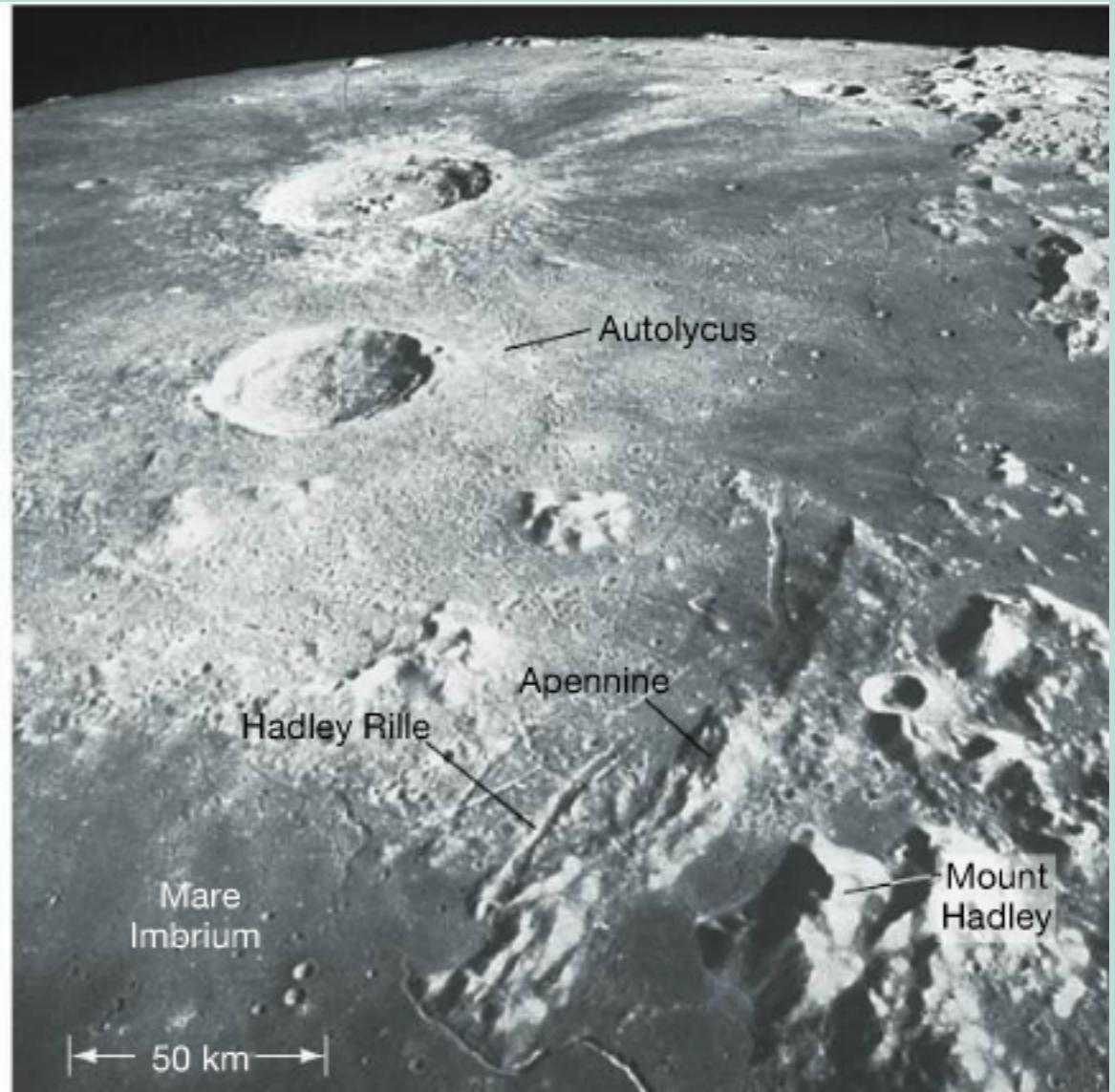
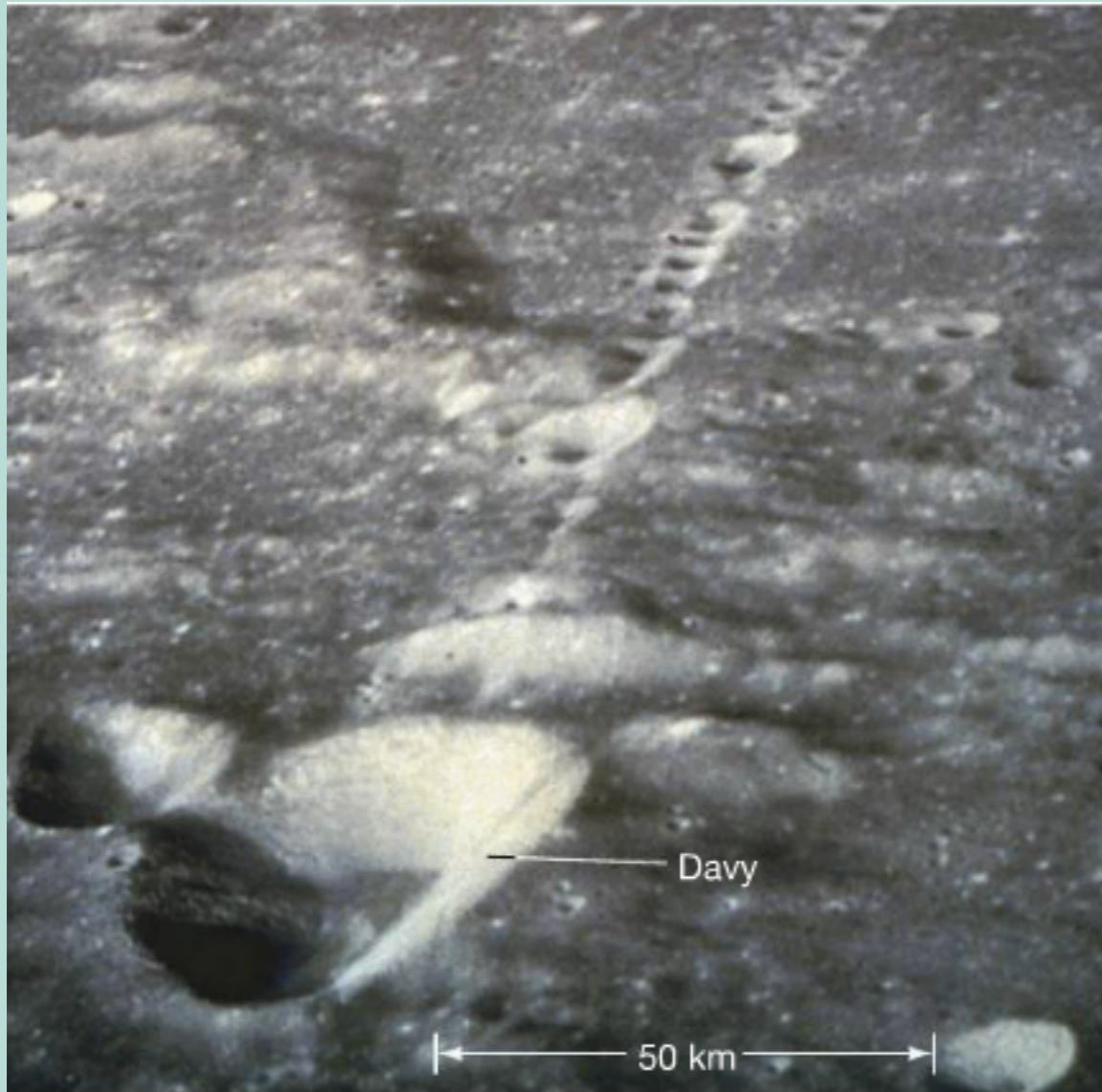
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## Mini-meteors



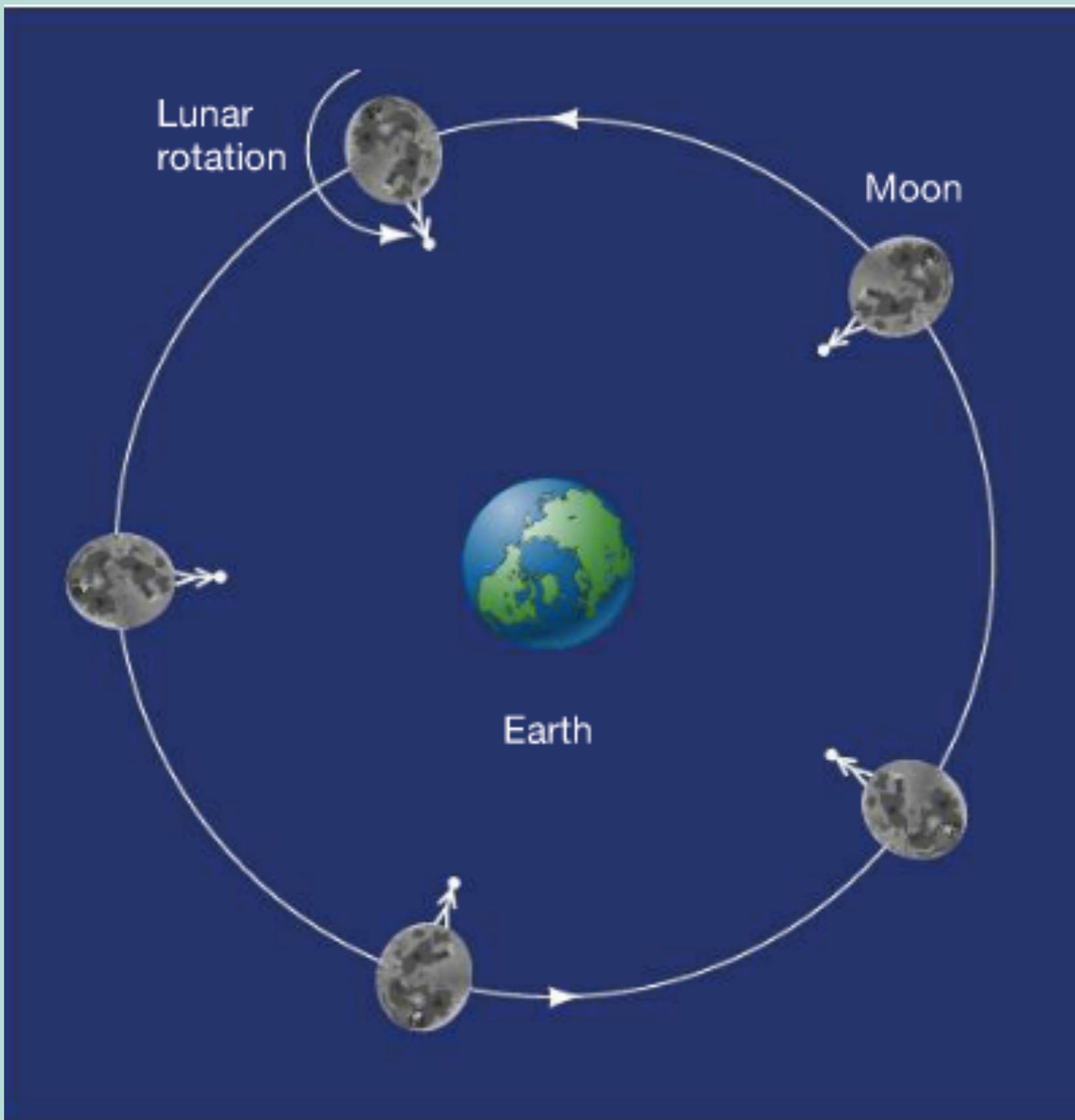
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## Chain Volcanic Activity



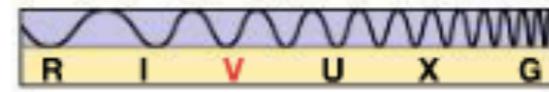
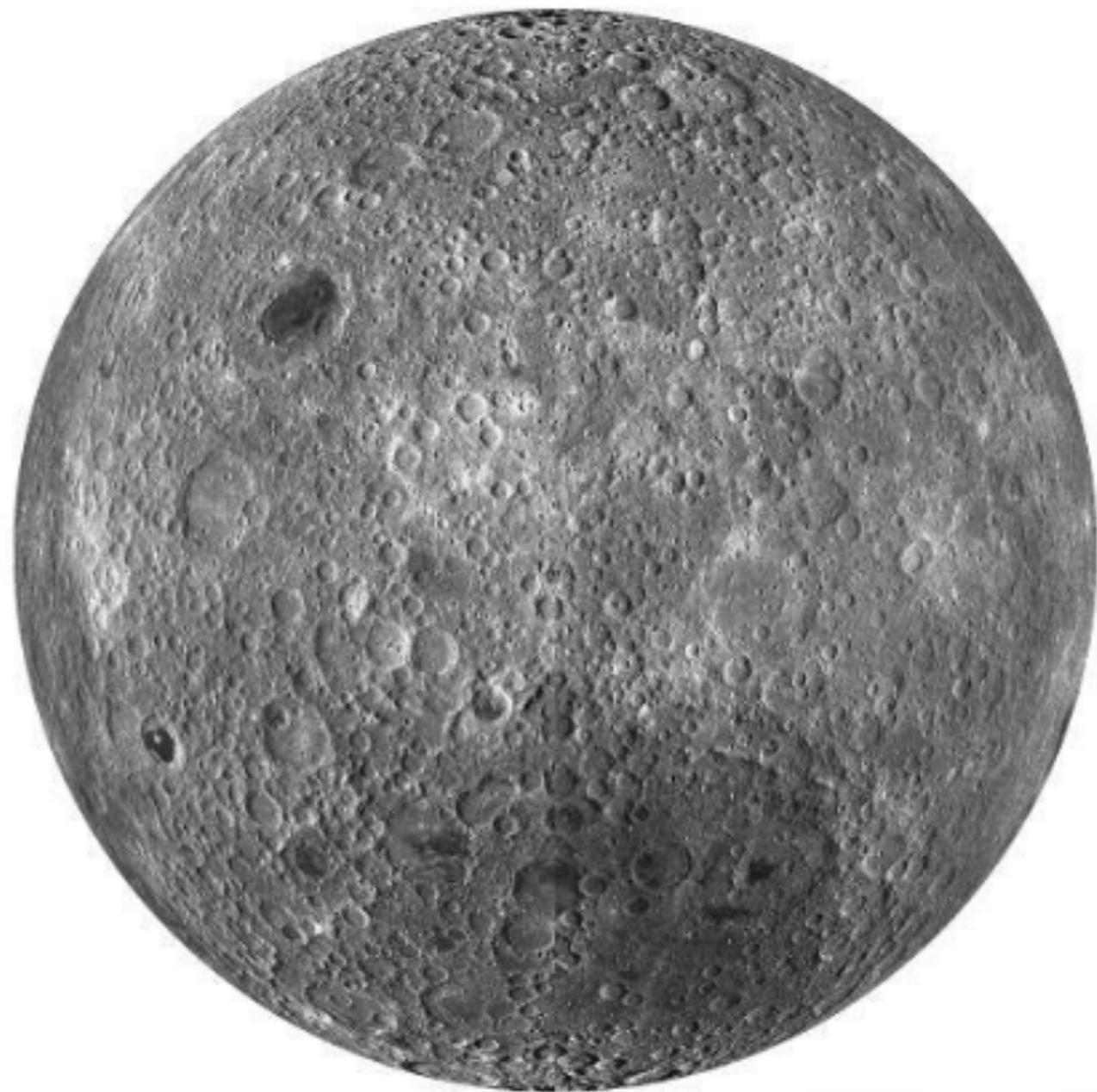
# The Moon and Mercury: Ch 8

## Tidal Lock



# The Moon and Mercury: Ch 8

## Dark Side of the Moon



# The Moon and Mercury: Ch 8

## Lunar Evolution



(a) 4 billion years ago



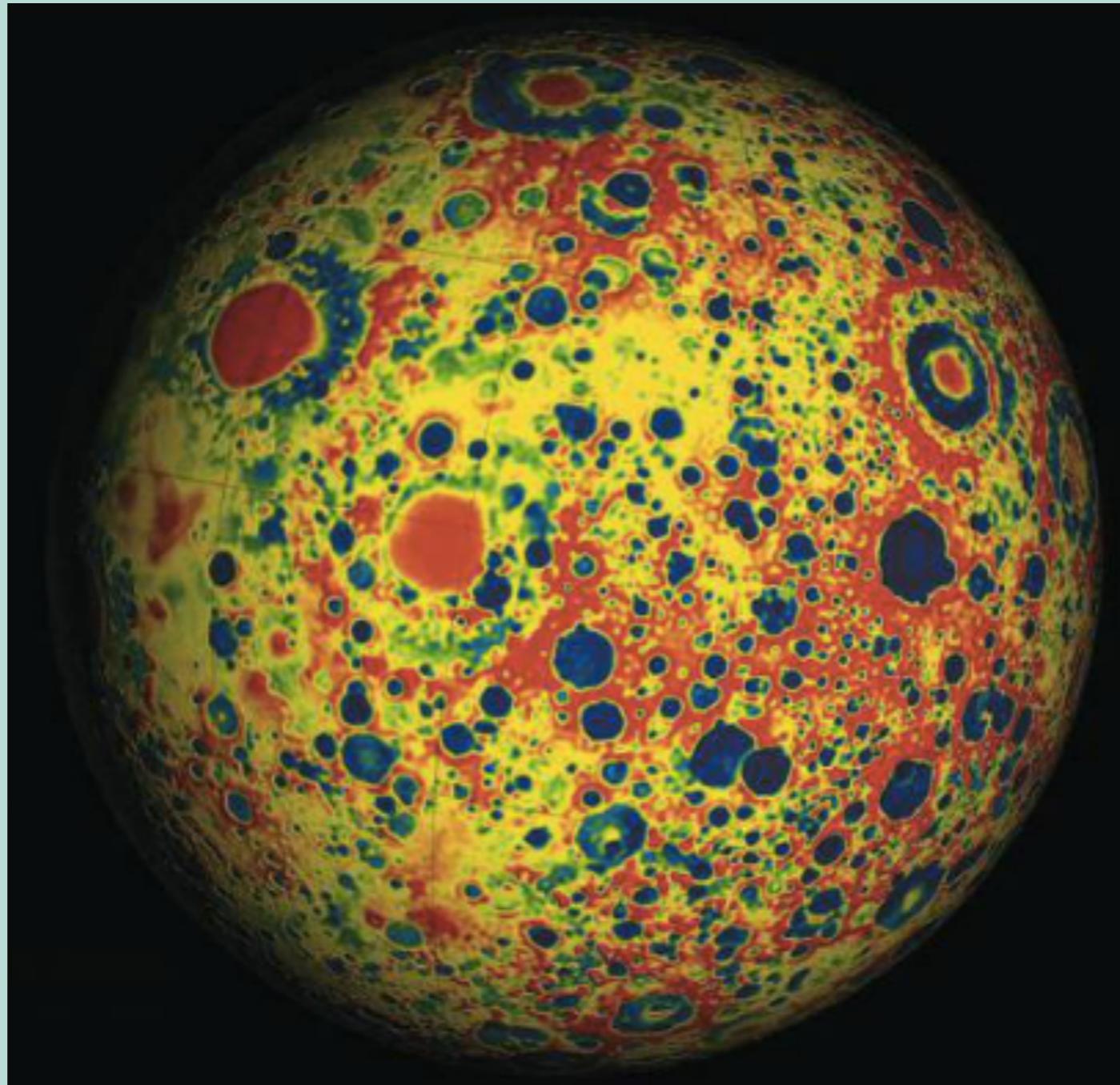
(b) 3 billion years ago



(c) Today

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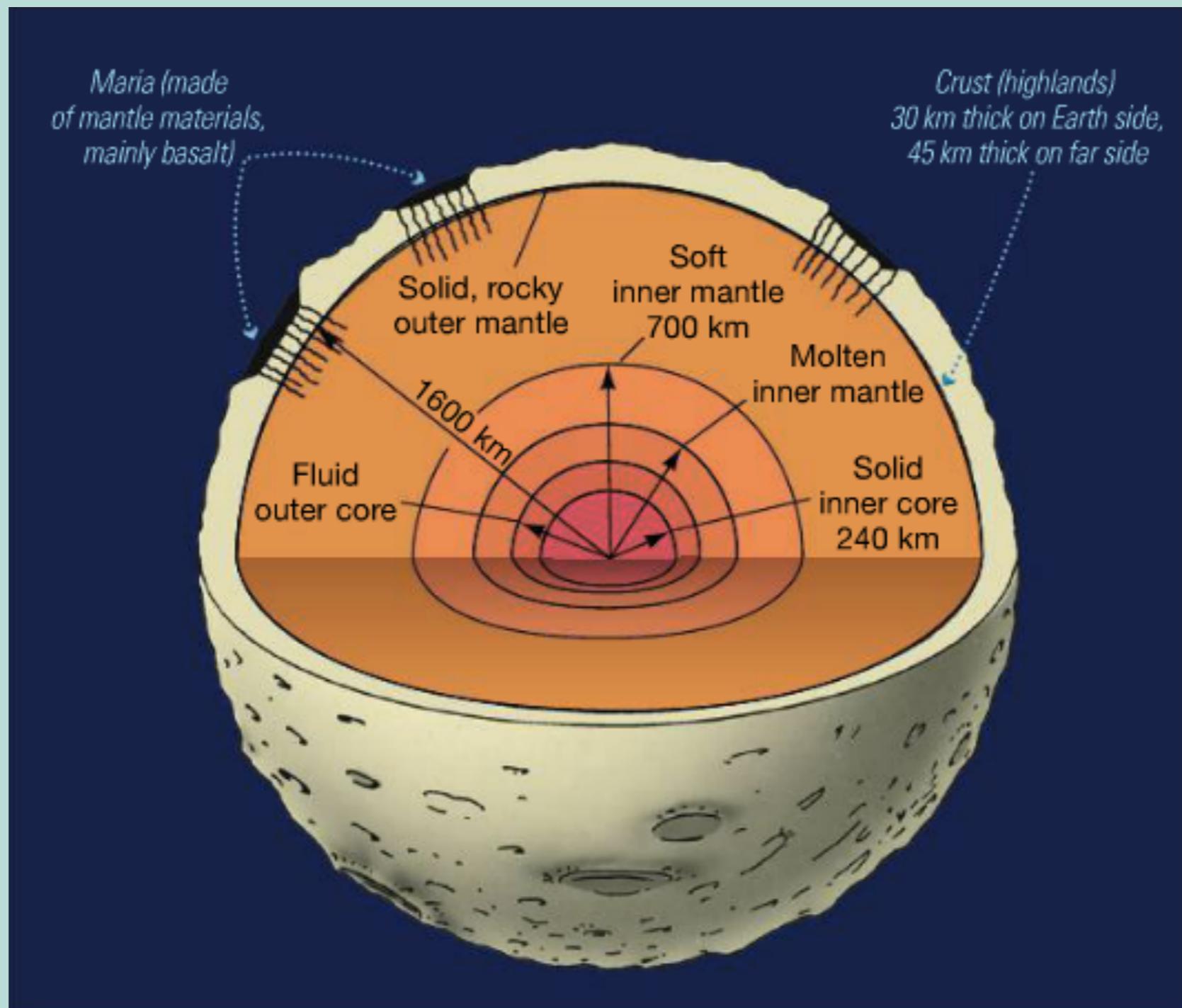
GRAIL



(Gravity Recovery and Interior Laboratory)

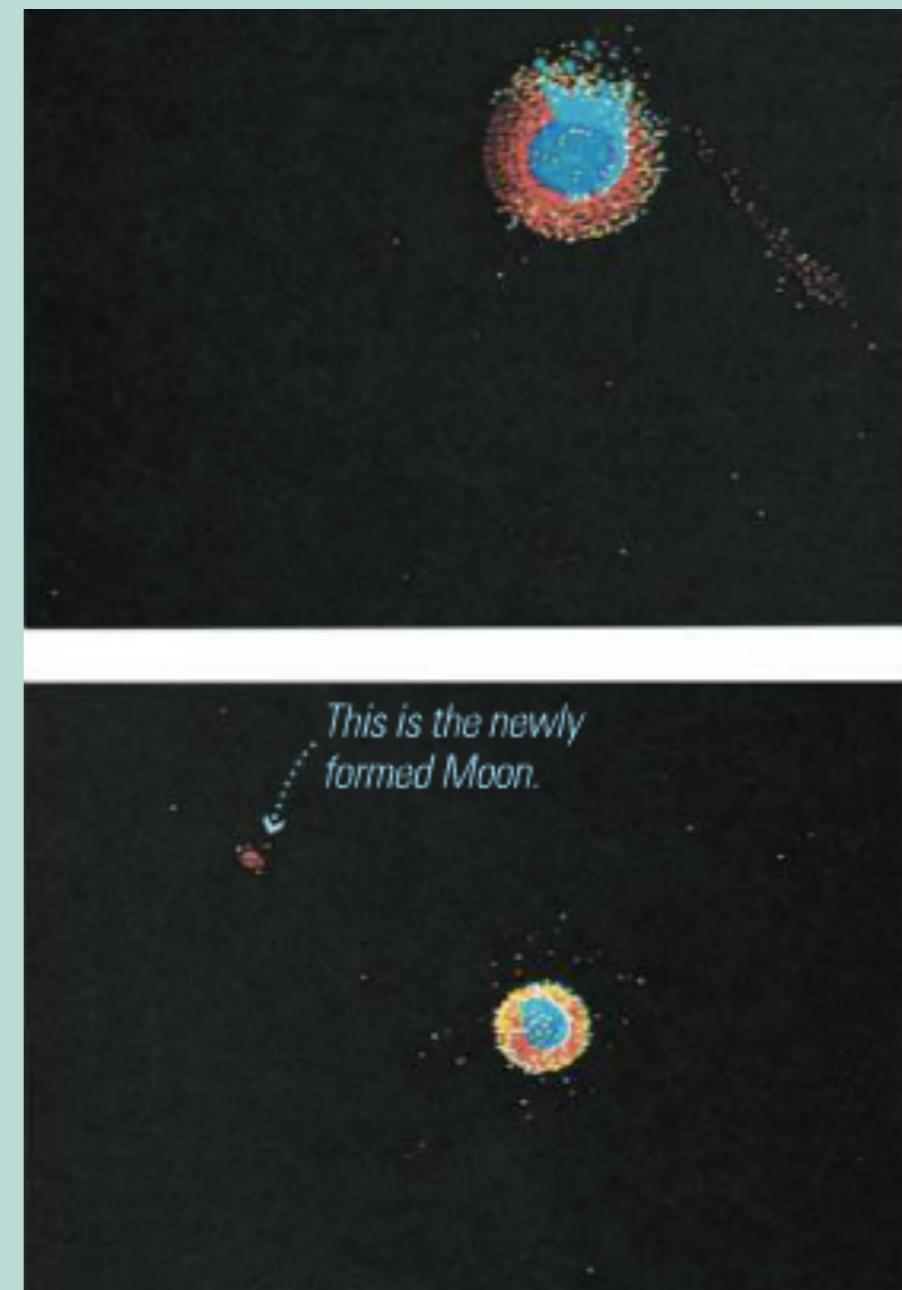
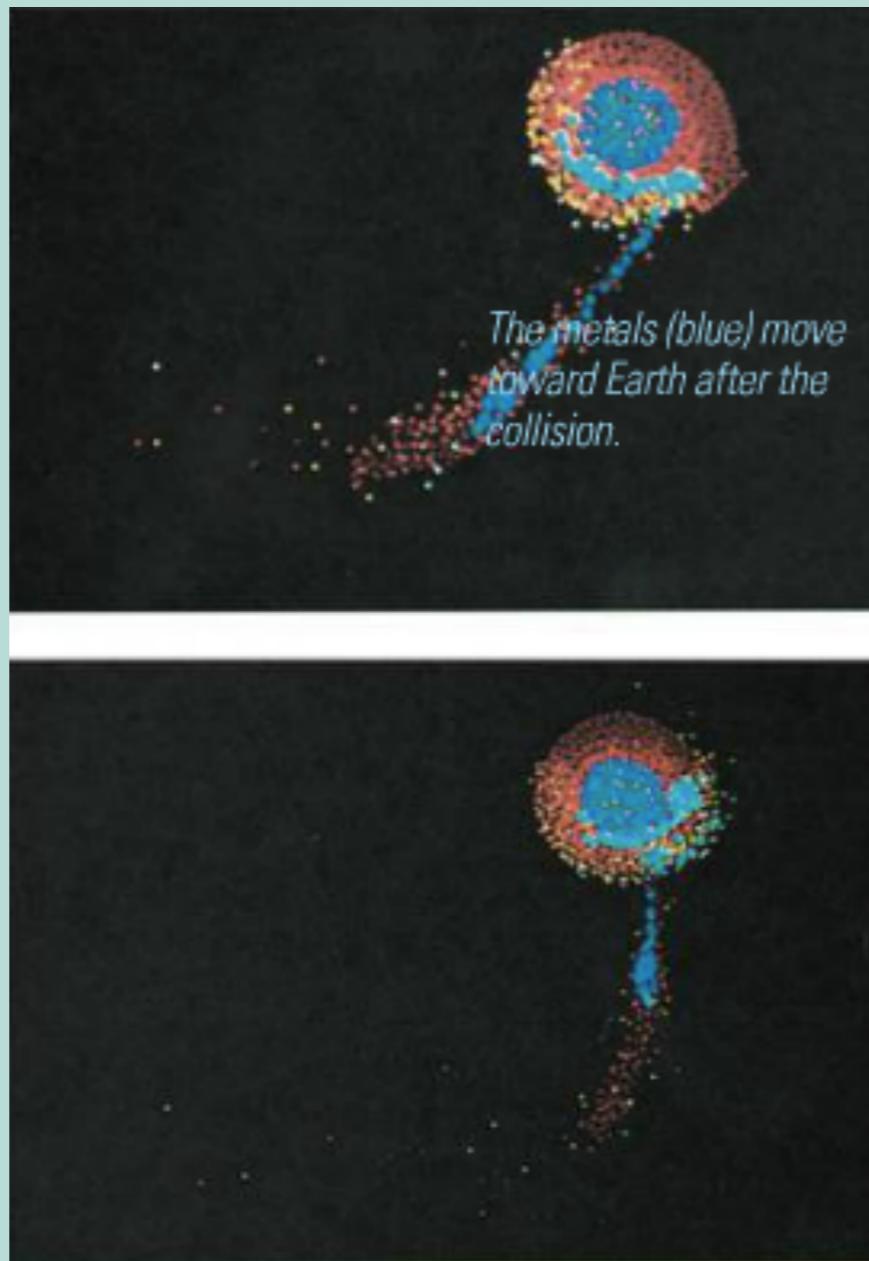
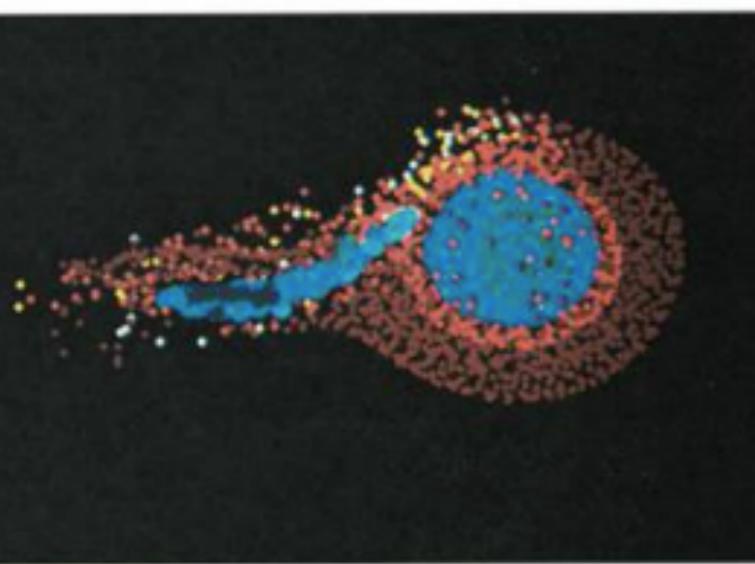
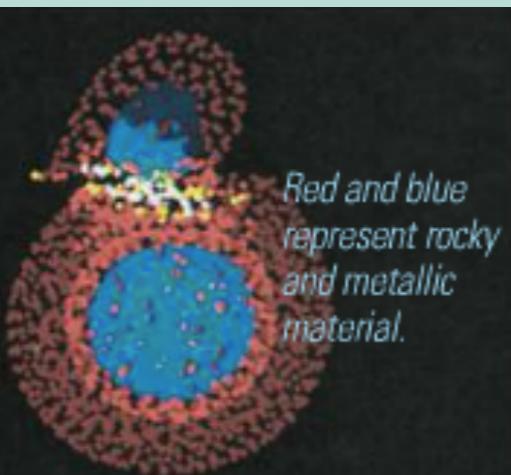
# The Moon and Mercury: Ch 8

## Chomp



# The Moon and Mercury: Ch 8

## Impact Theory



Moon Origins  
Coformation? Capture? Fission?

# The Moon and Mercury: Ch 8



DISCUSSION

# The Moon and Mercury: Ch 8



Mercury

$m \sim 3.3 \times 10^{23}$   
 $\sim 1/18 M_e$

$r \sim 2.4 \times 10^6$   
 $\sim 8 \text{ ms}$   
 $\sim .38 M_e$

$d_{\text{sun}} \sim$   
.3 AU  
 $\sim 2.5 \text{ min}$

$e = .2$   
 $\sim .08 e_{\text{earth}}$

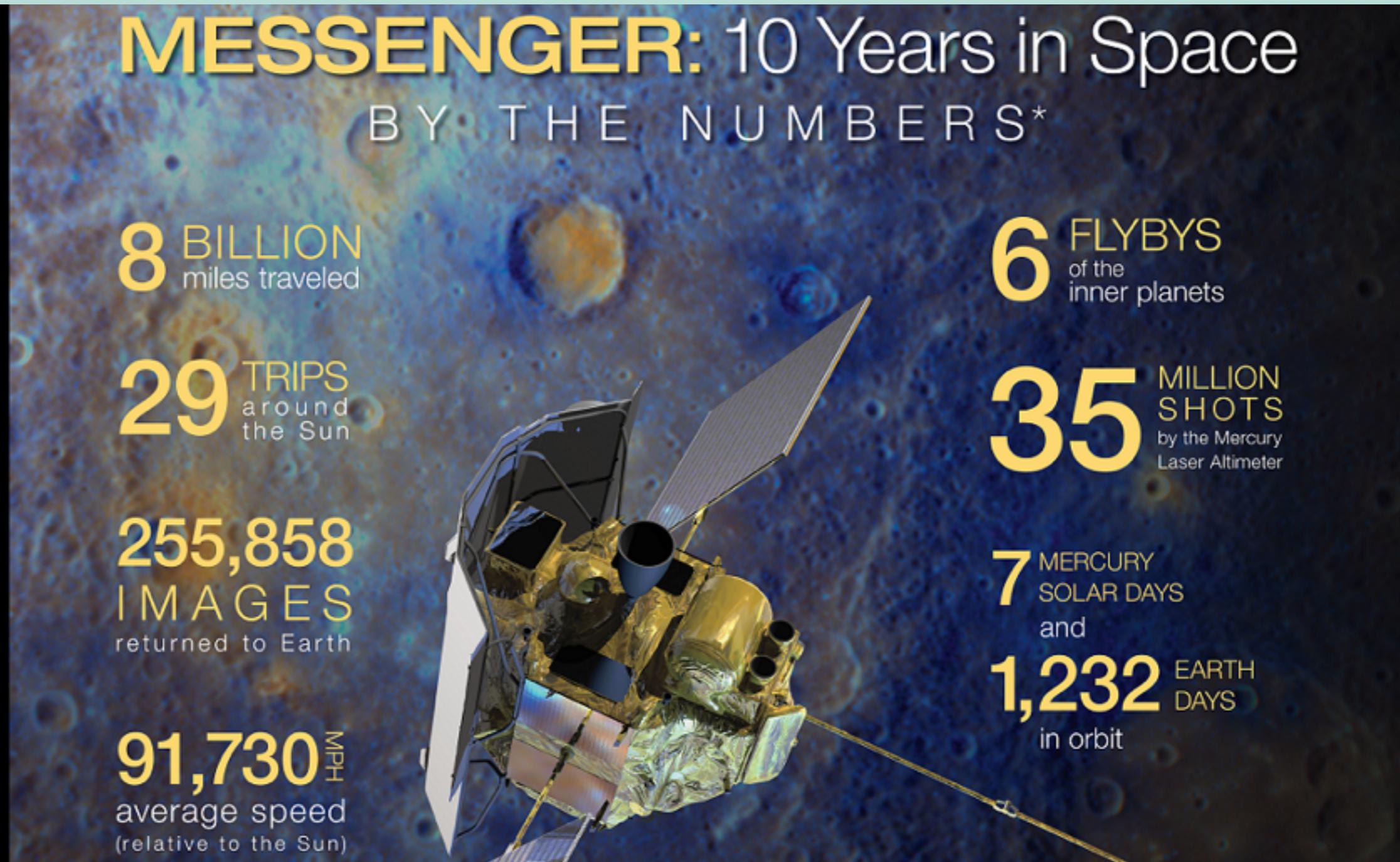
# The Moon and Mercury: Ch 8

## Surface Temperature

Day: 700 K

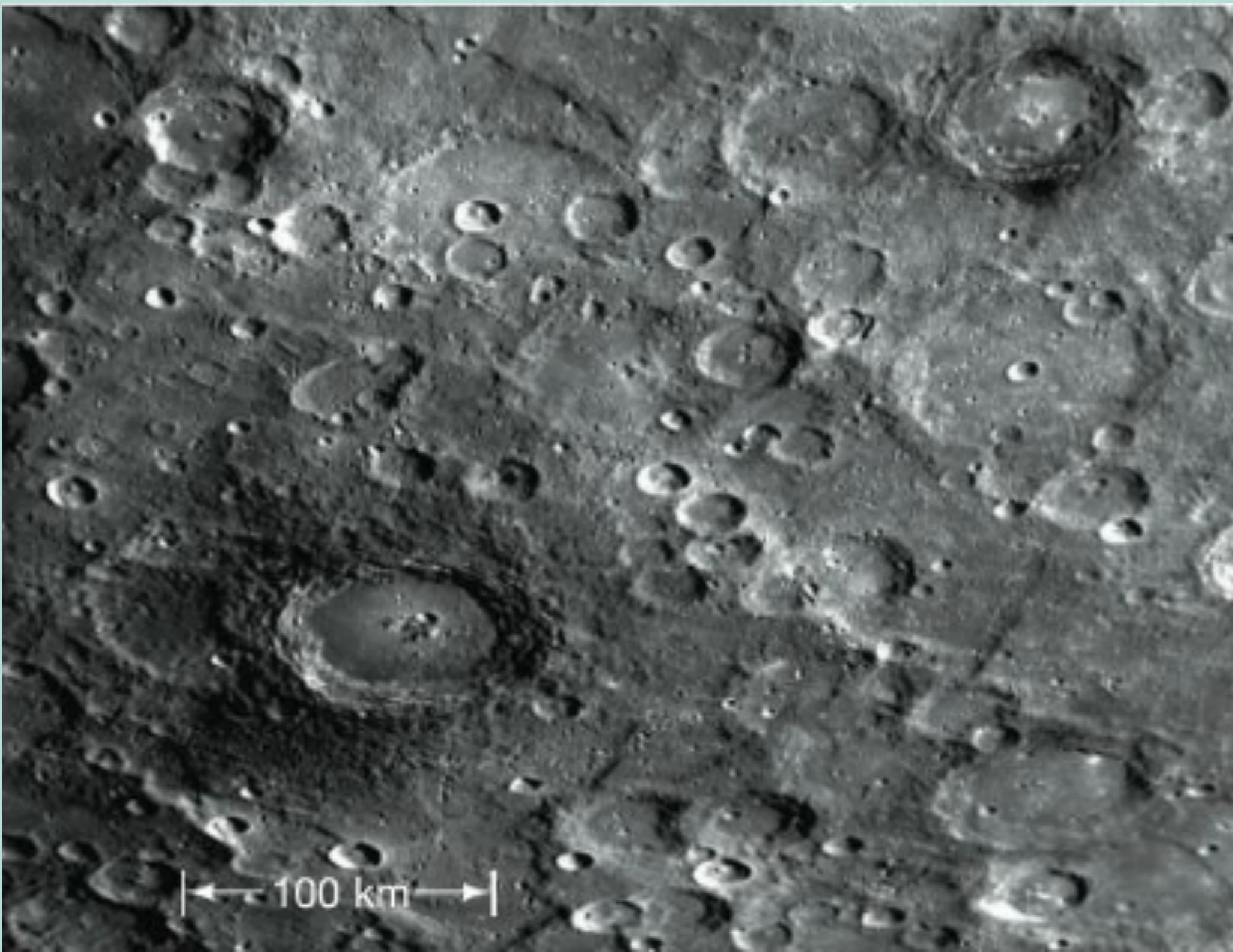
Night: 100 K

# The Moon and Mercury: Ch 8



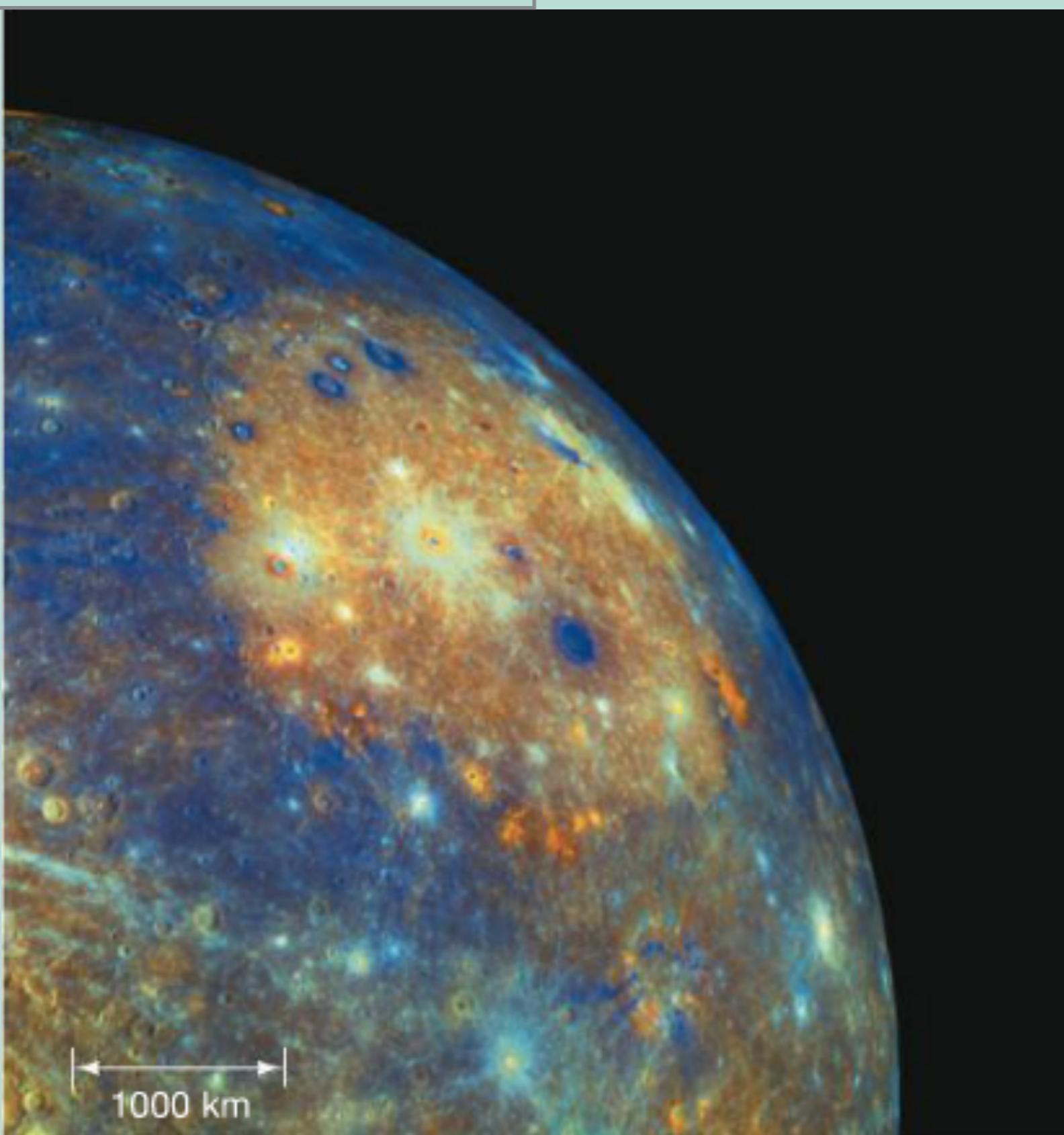
# The Moon and Mercury: Ch 8

## Mercury Up Close



# The Moon and Mercury: Ch 8

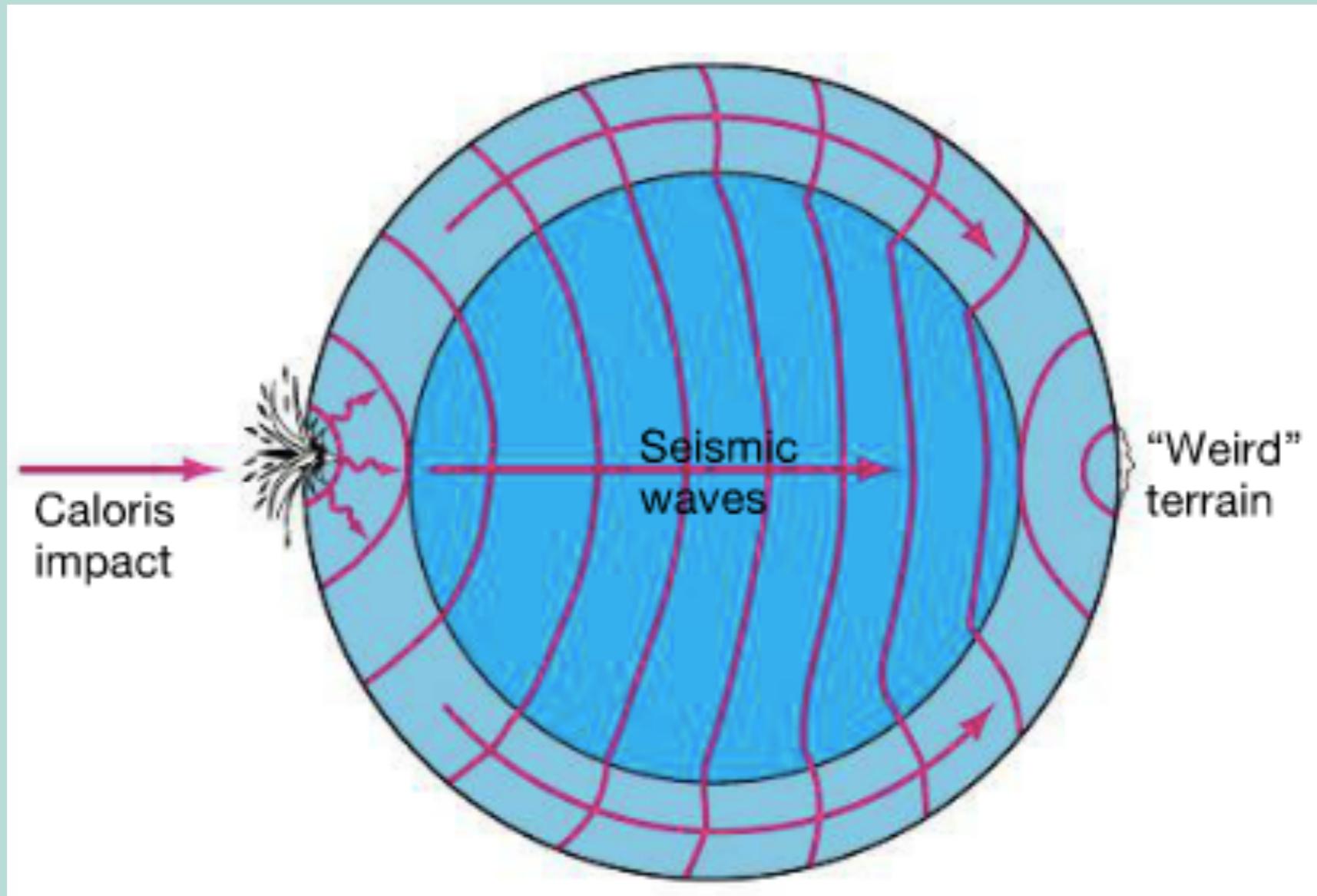
## Caloris Basin



1500 km across

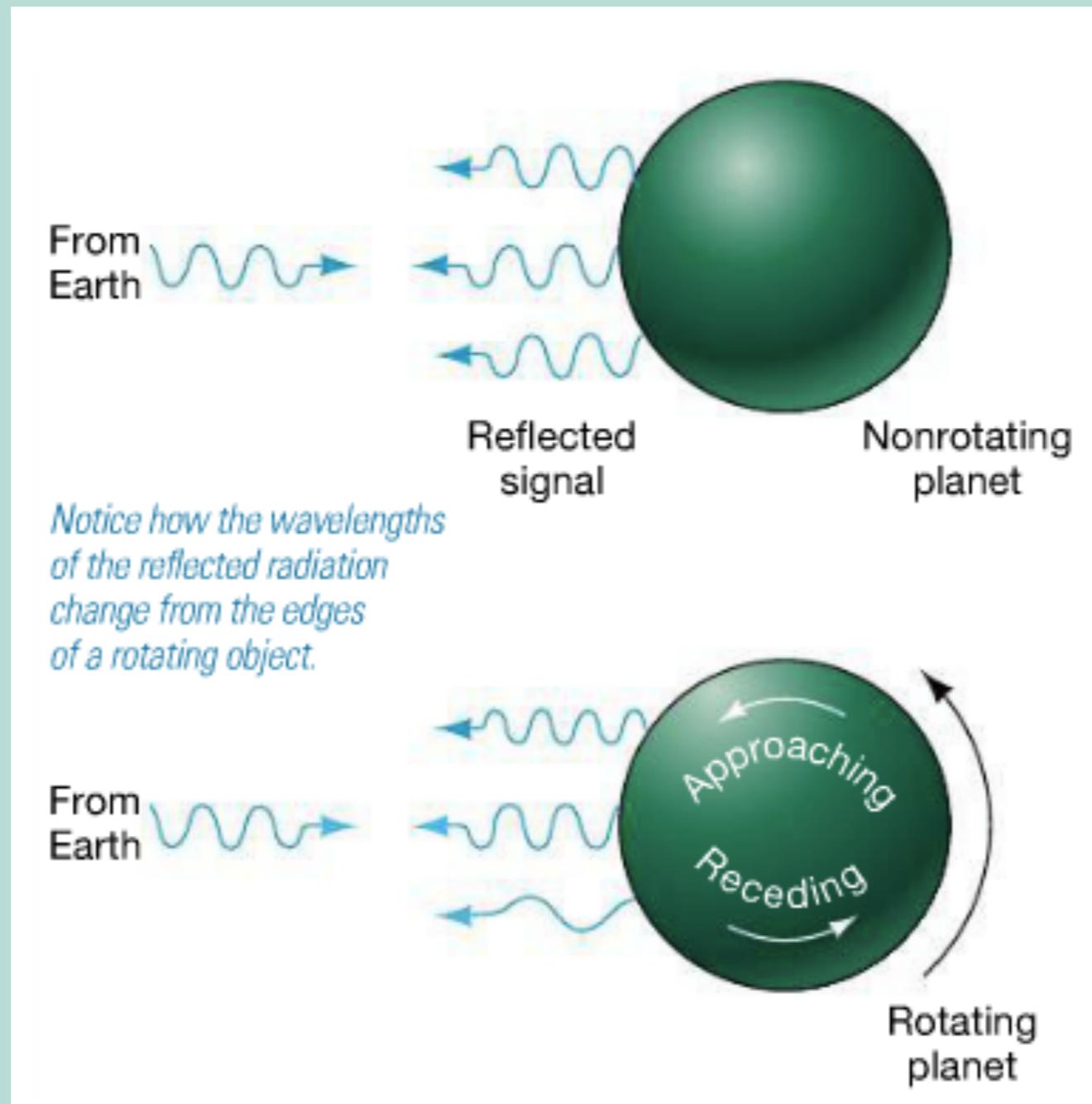
100 km meteor

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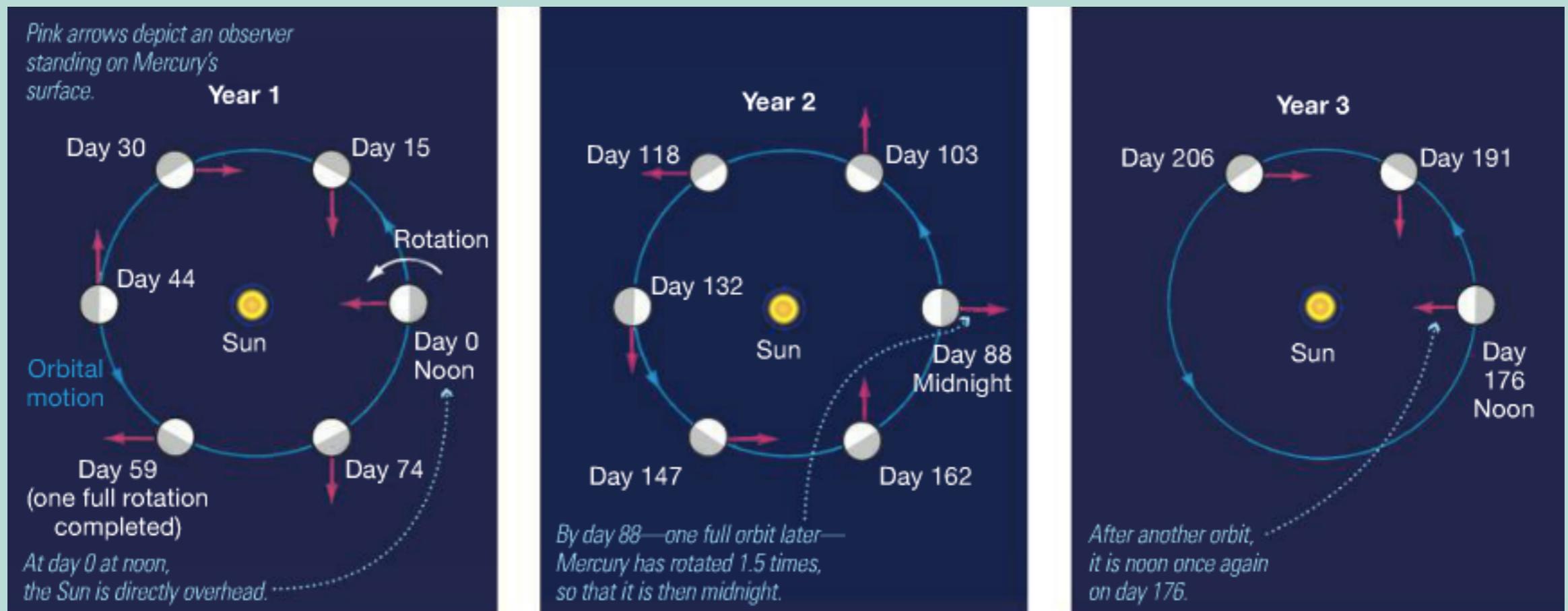
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## Mercury is rotating!



# The Moon and Mercury: Ch 8

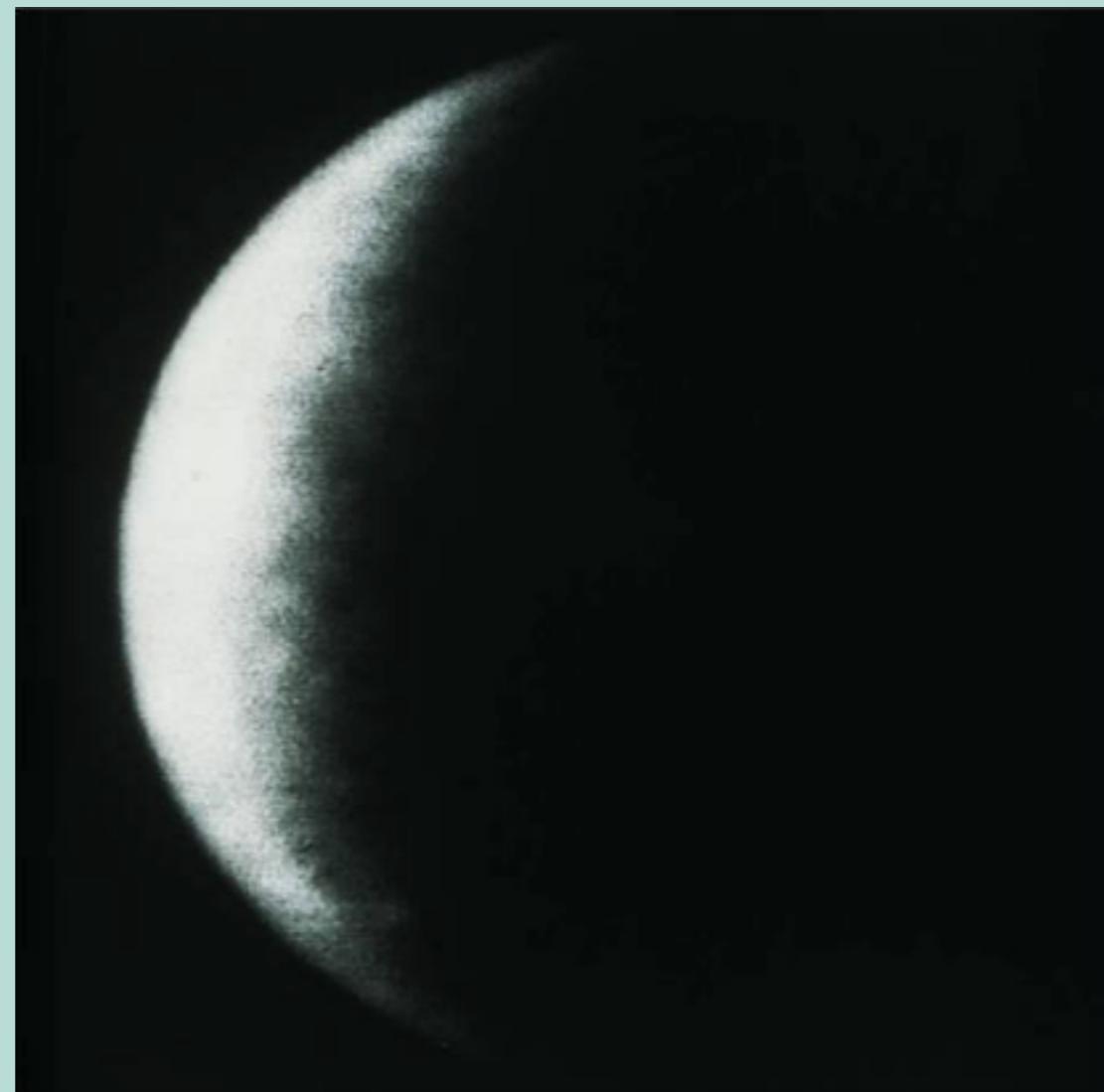
## 3:2 resonance



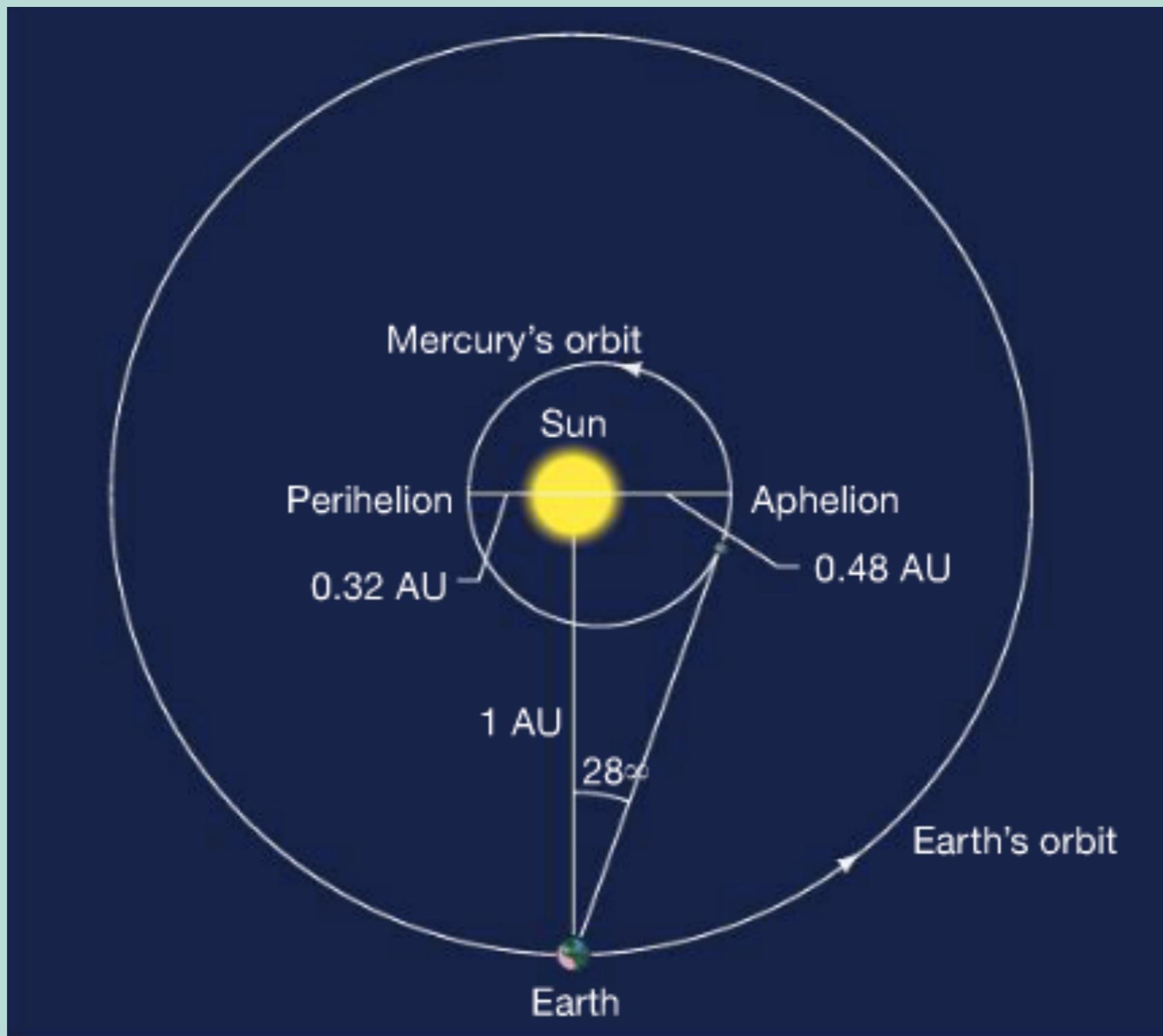
1 “day” is 2 “years” long!

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## Mercury from Earth

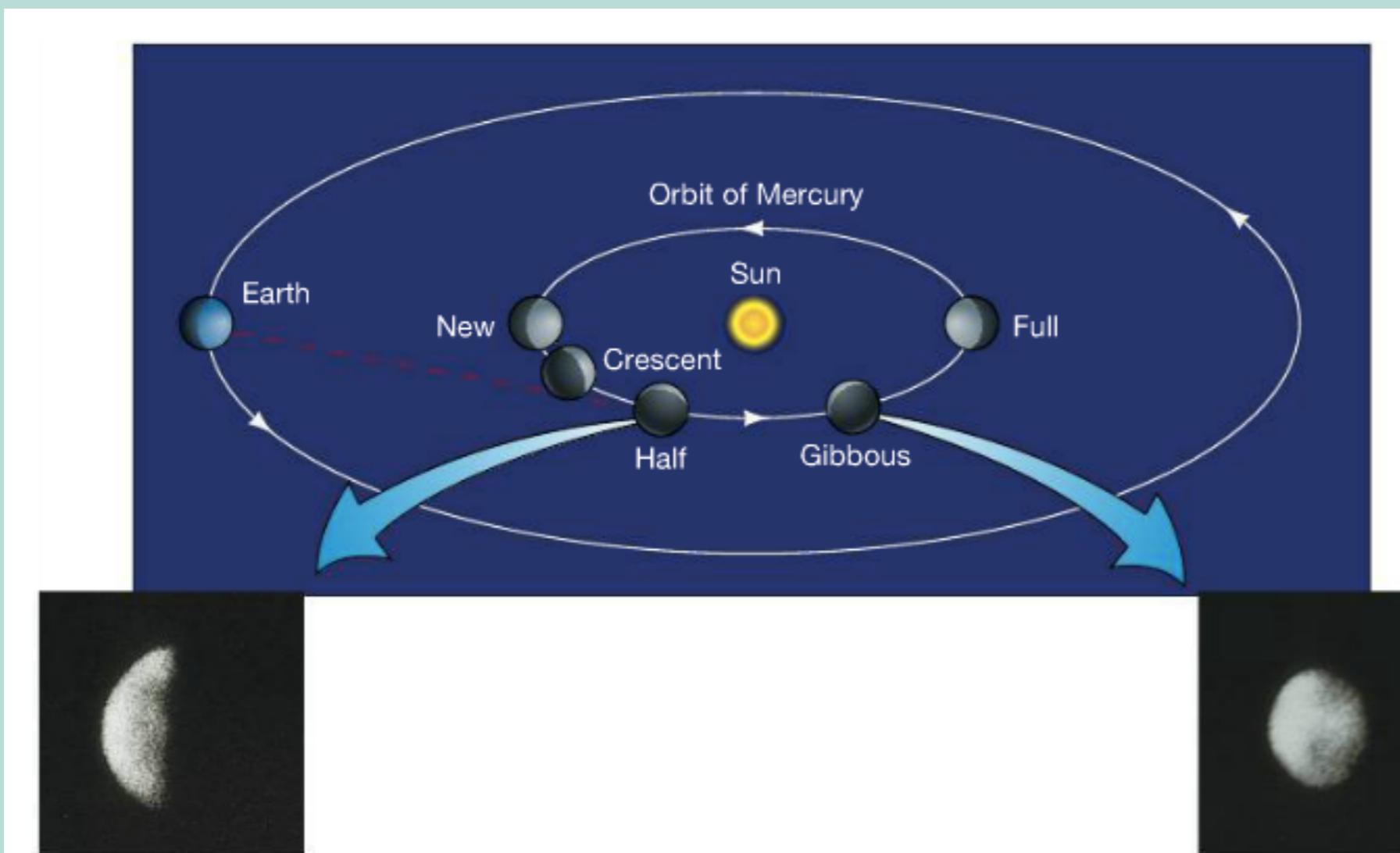


# The Moon and Mercury: Ch 8



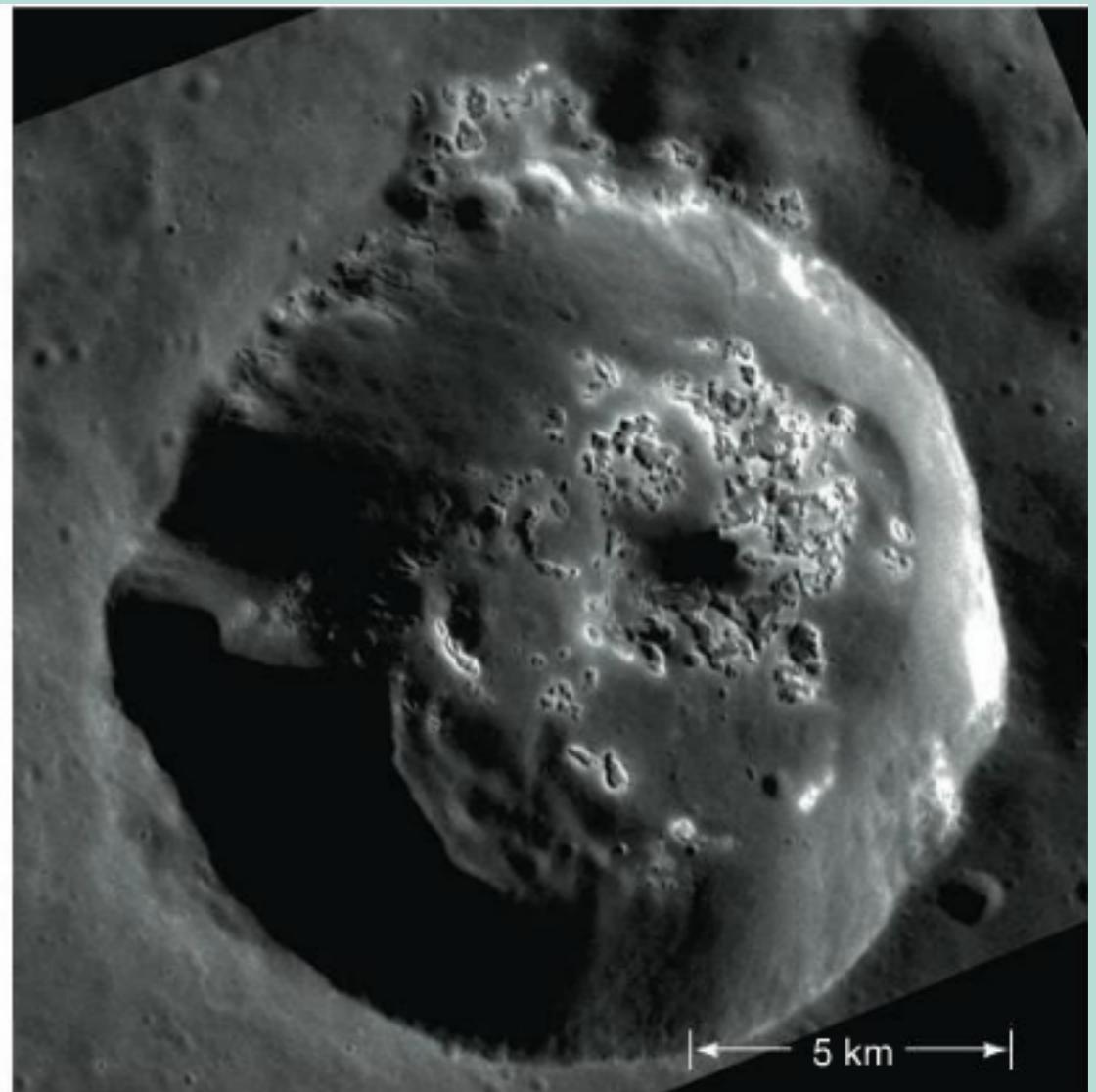
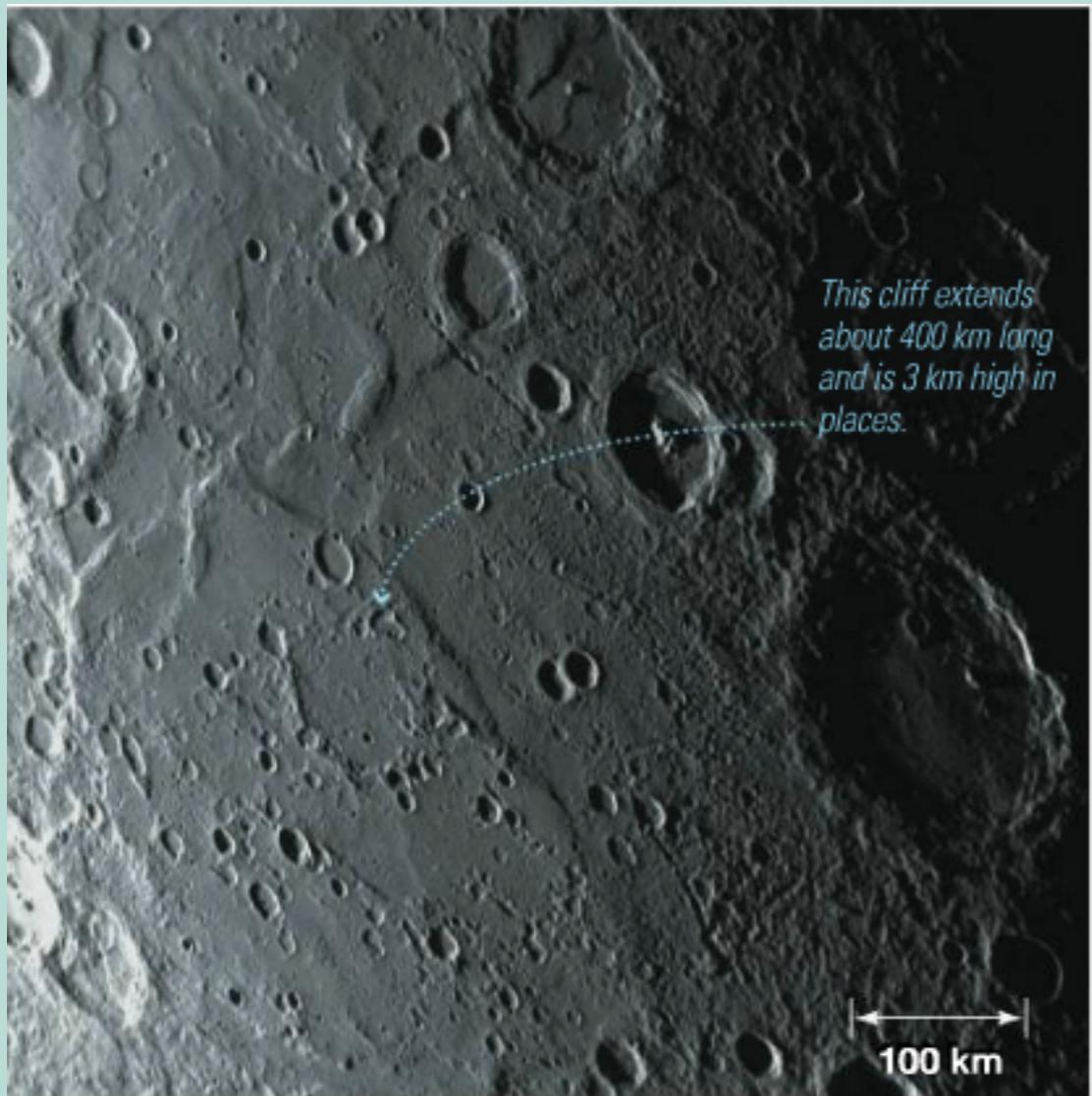
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## Half Mercury



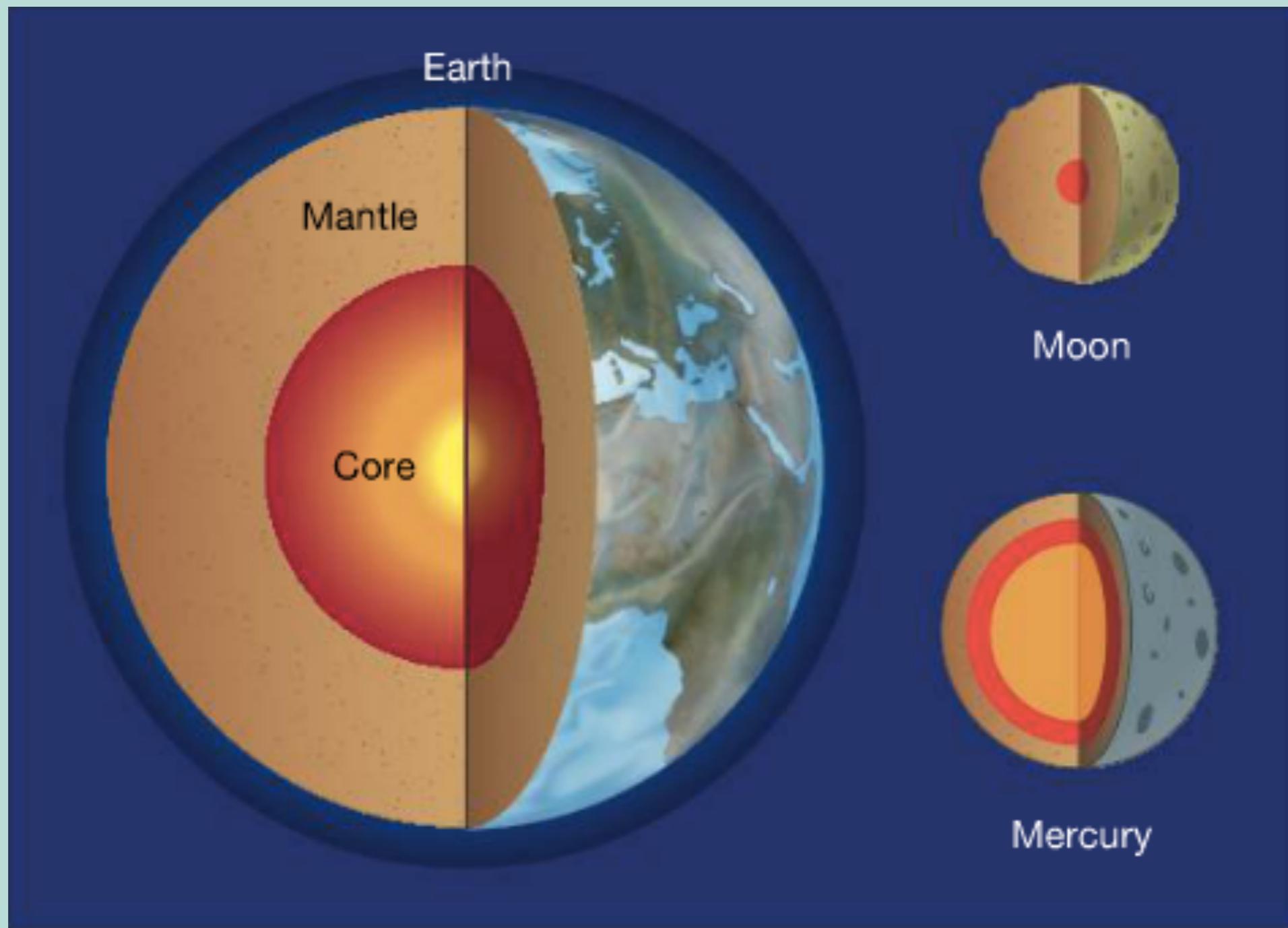
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## Hollows and Scapes



# The Moon and Mercury: Ch 8

## Interior Comparison



Mercury has an active magnetic field! (unlike the moon)