

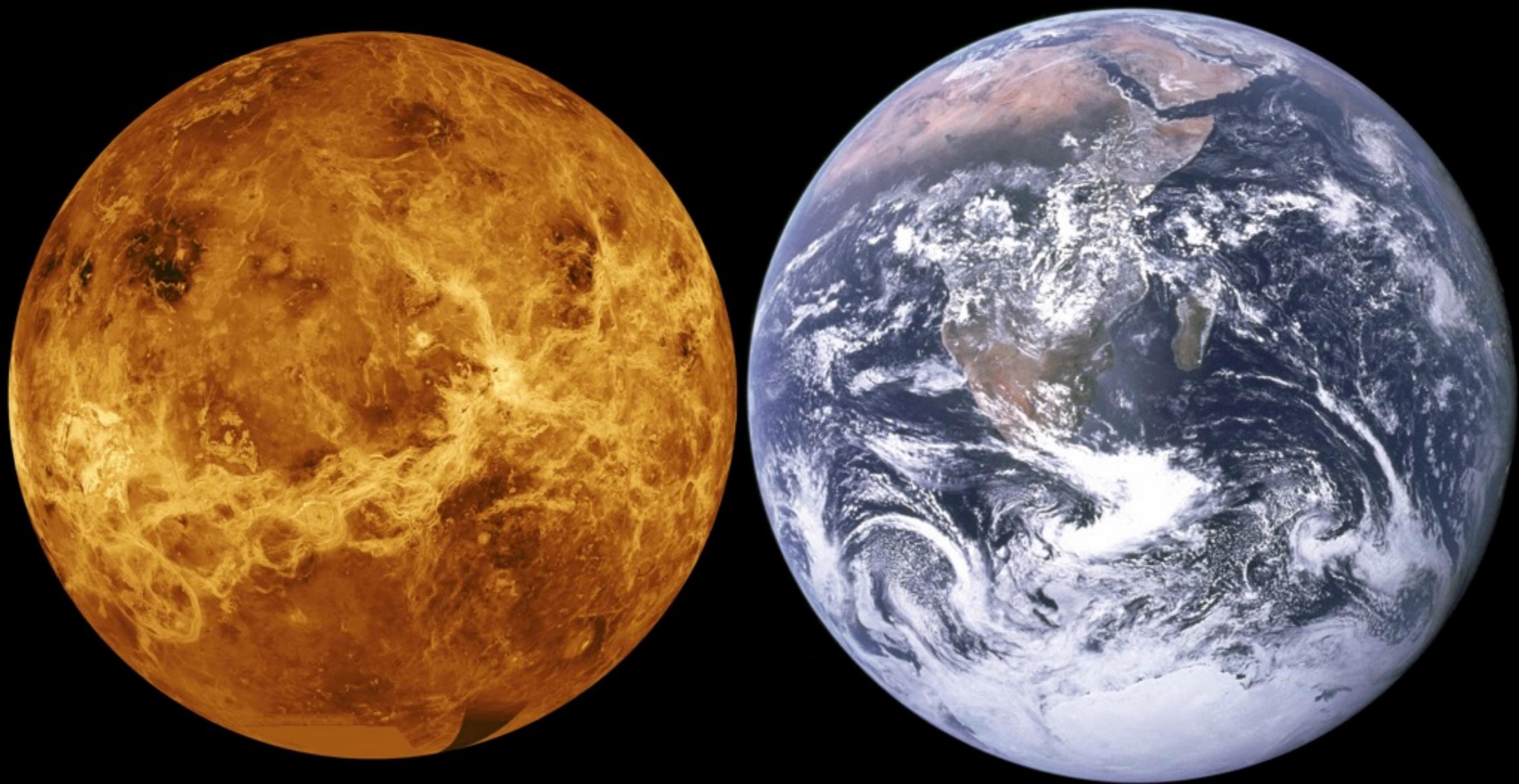


with your host:



Lecture 8: Venus

Coop



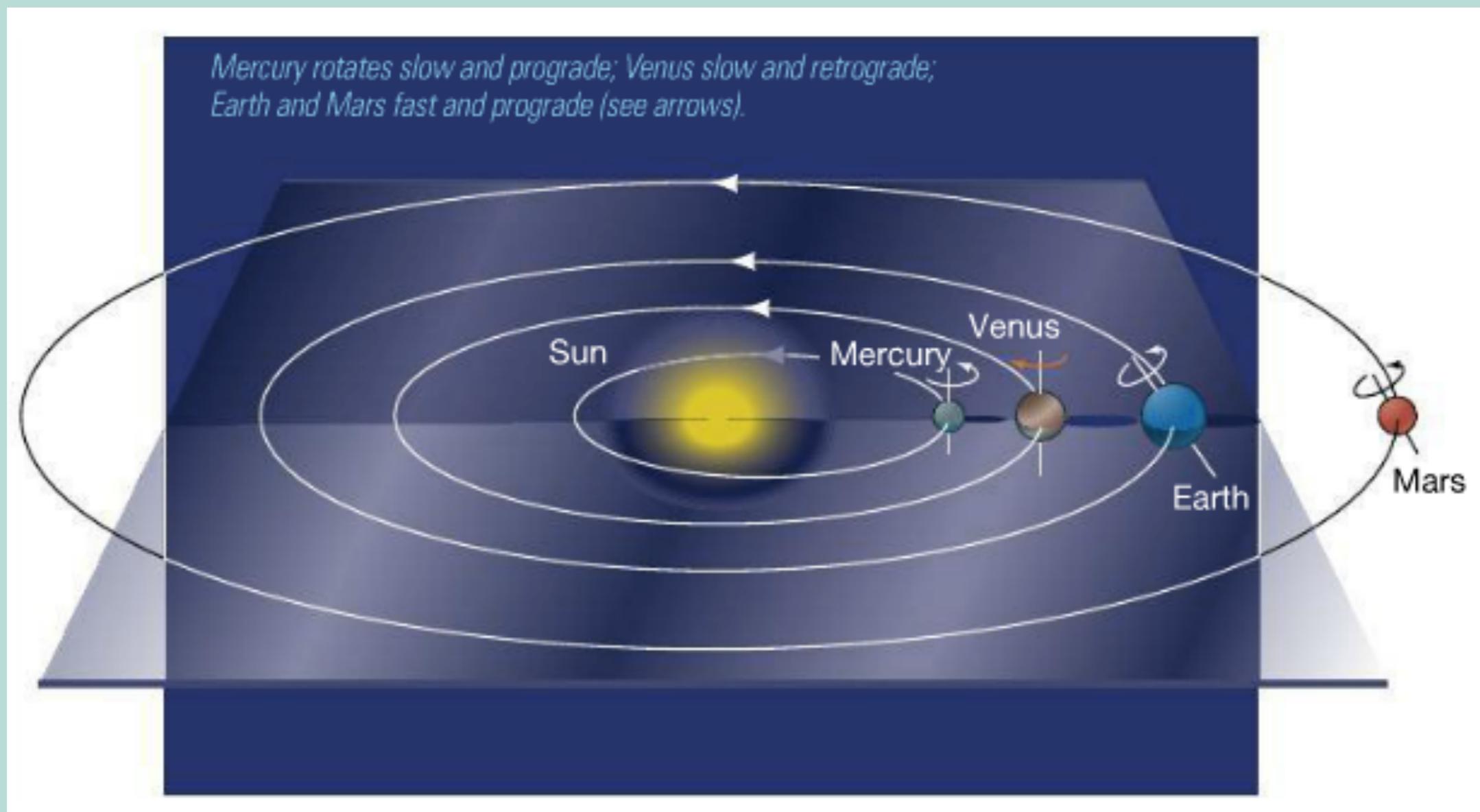
Venus

$m \sim 4.9 \times 10^{24} \text{ kg} \sim .815 m_e$

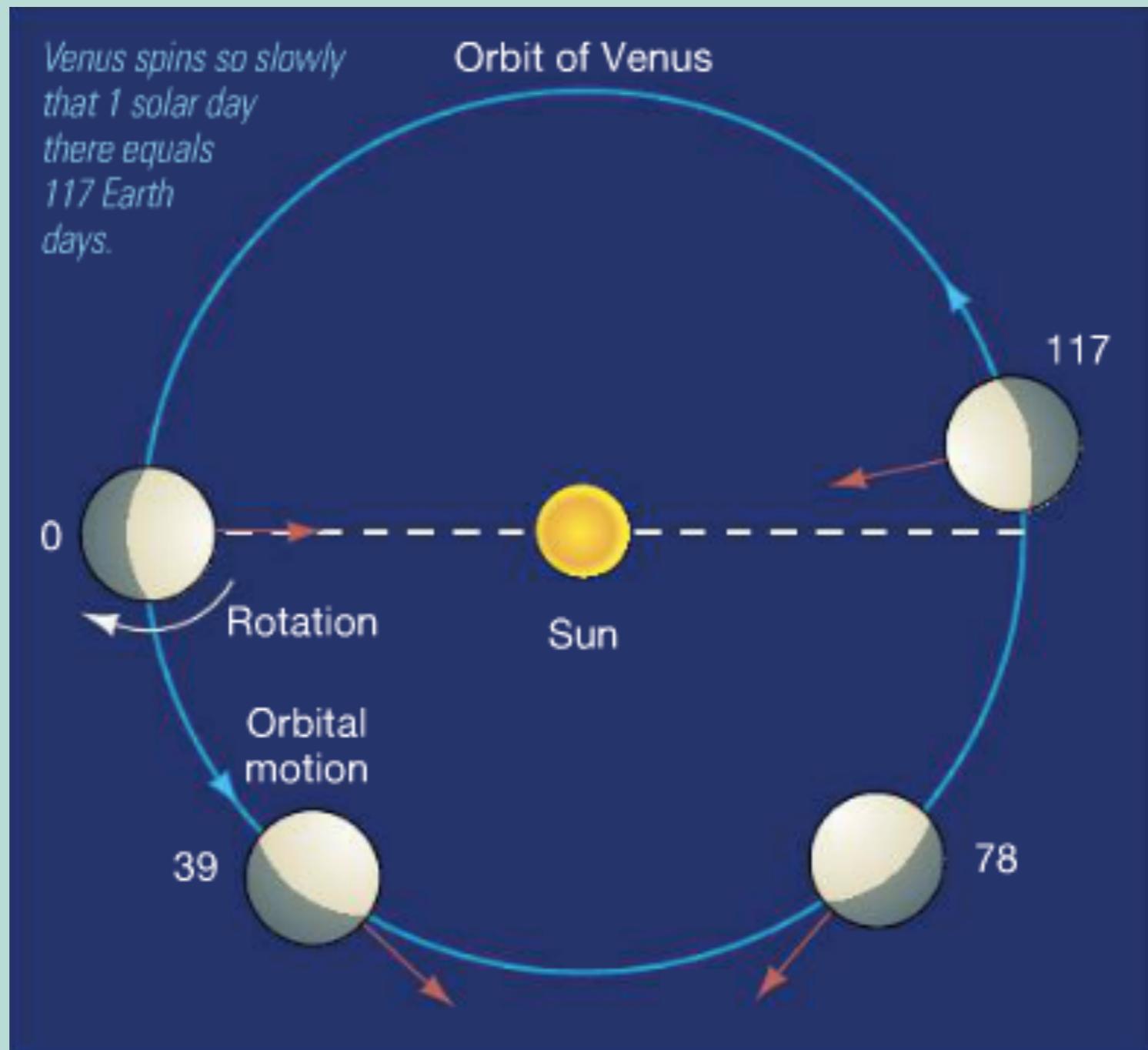
$r \sim 6000 \text{ km} \sim .95 r_e \sim .02 \text{ s}$

$d_{\text{sun}} \sim 108,000 \text{ km} \sim .72 \text{ AU} \sim 6 \text{ min}$

Rebel in Retrograde Motion

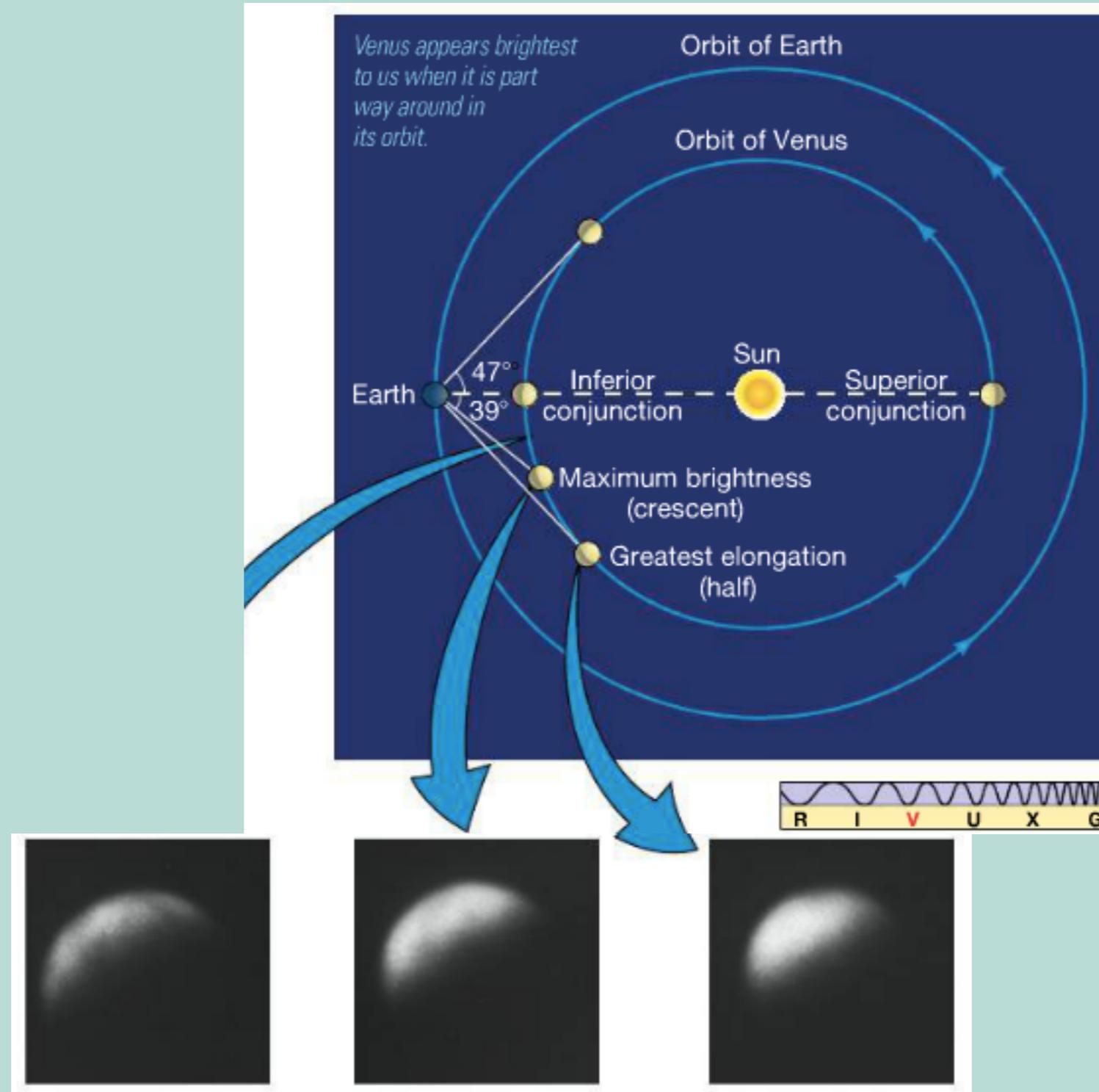


Slow Venusian Spin

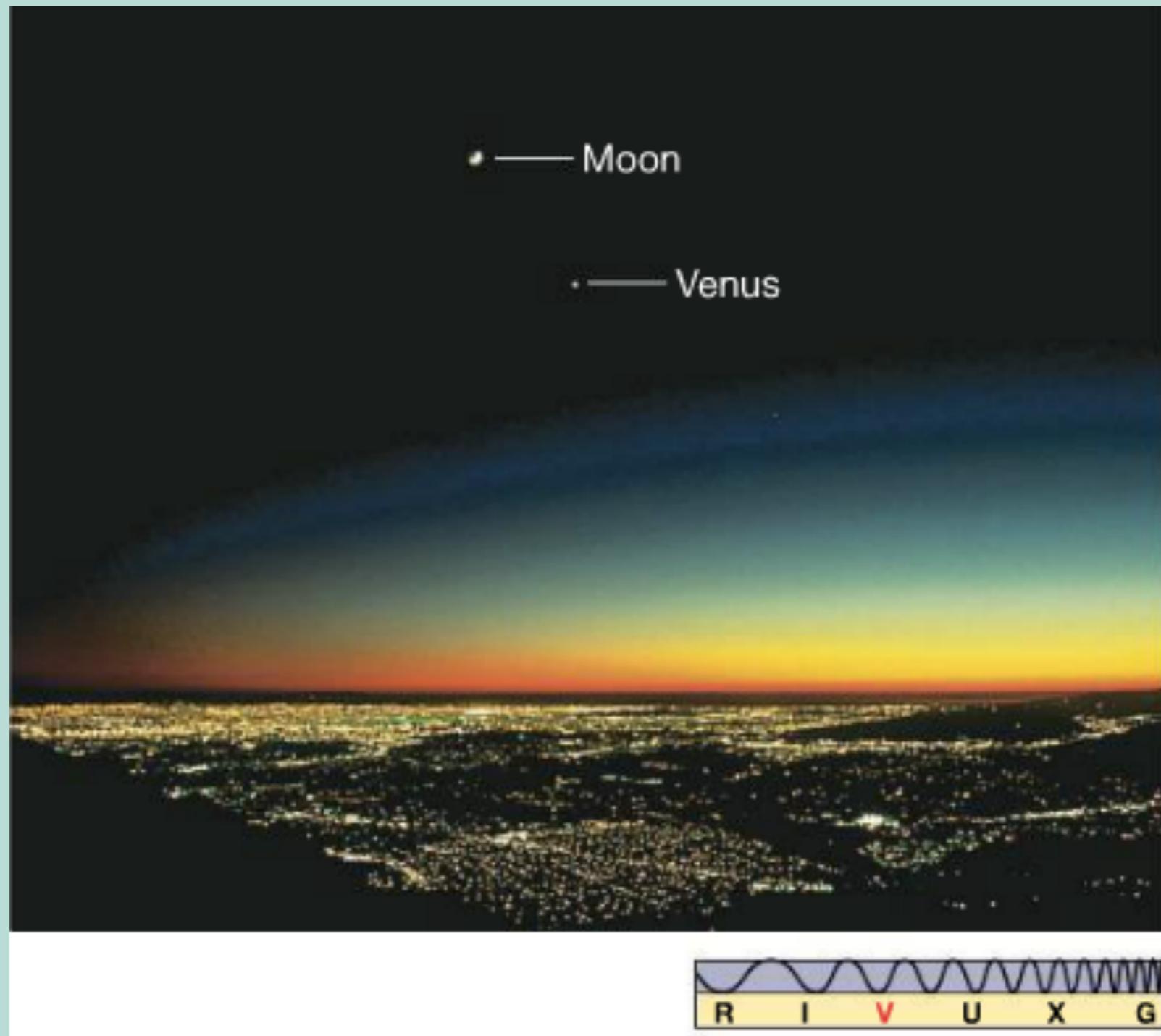


5 to 1 resonance facing us on fly-bys

Maximum Brightness



10x brighter than Sirius (the brightest star)



You can see it during the day and it casts a shadow!

Dense Yellow Haze Obstructs Views from Earth



Surface Temperature:

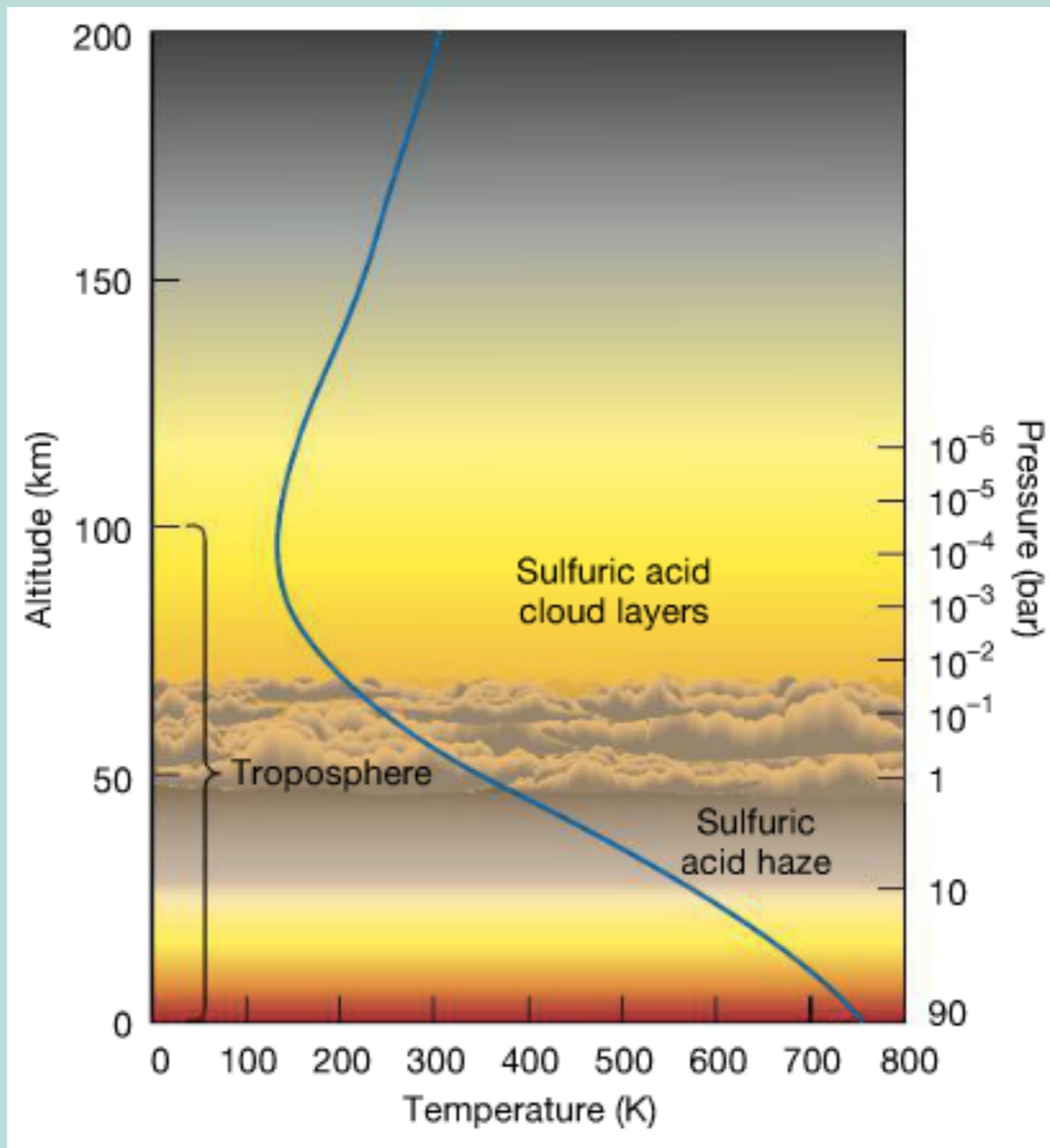
Day ~ 740 K

Night ~ 740 K

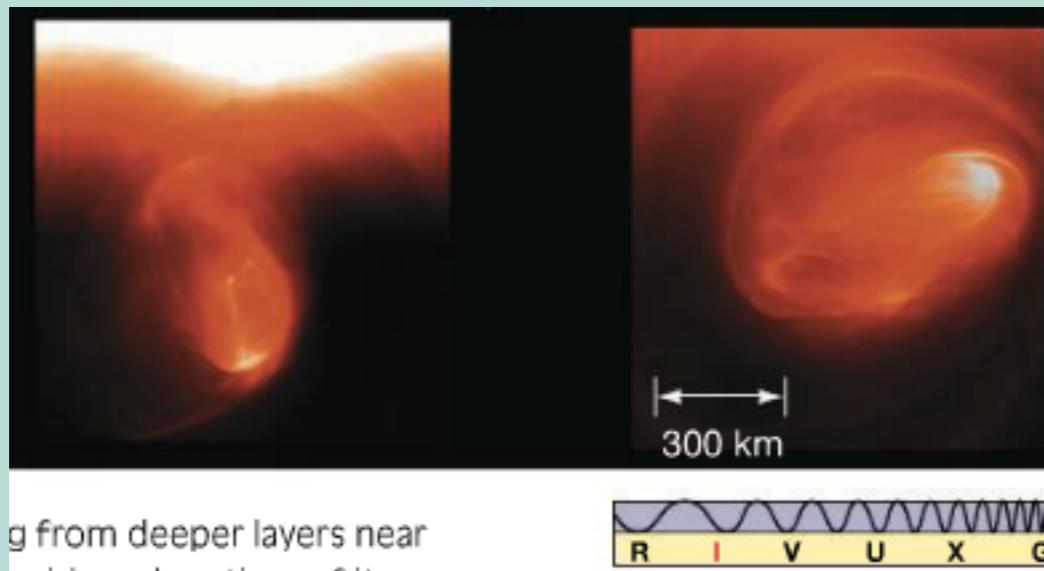
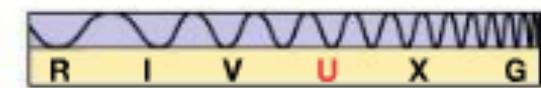
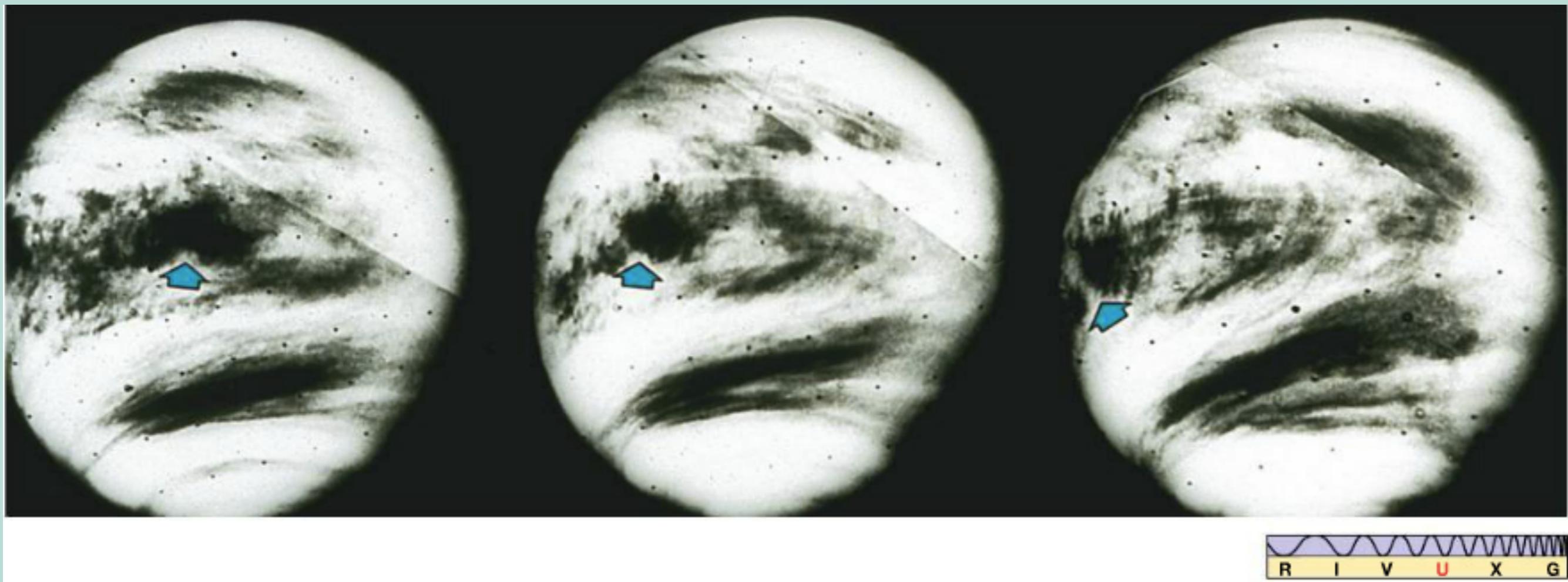
North Pole ~ 740 K

Melting point of lead:

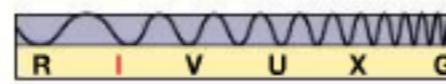
600 K

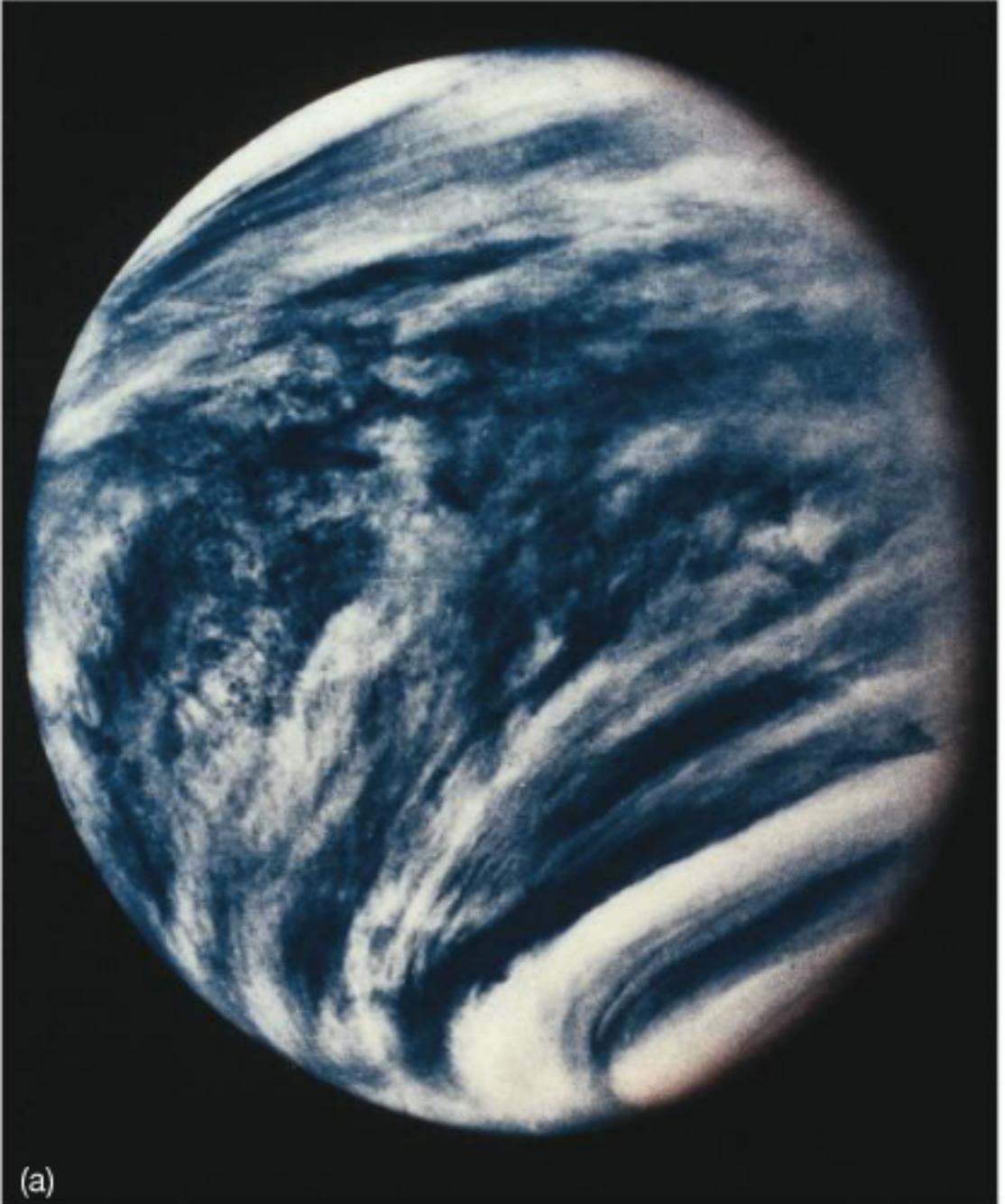


Sulfuric Acid Cloud Movement



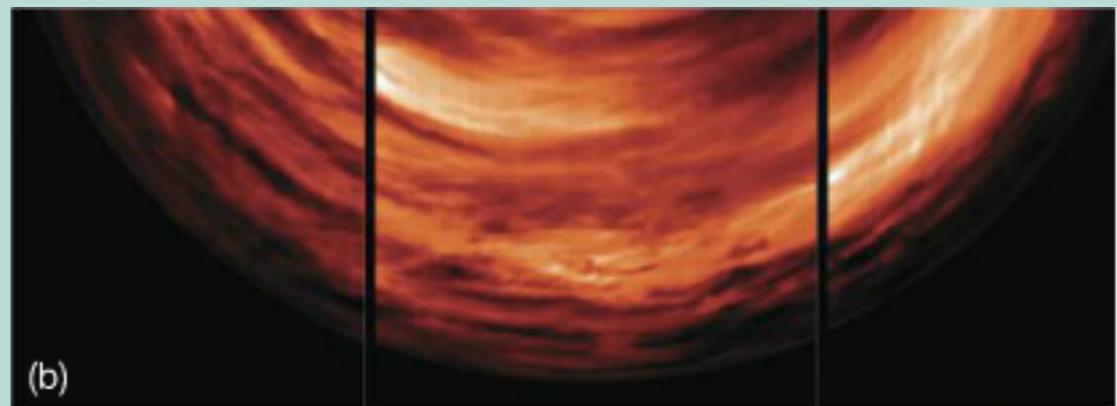
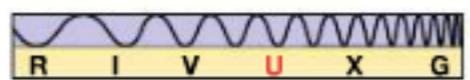
Polar Vortex



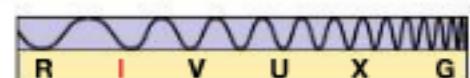


Venus in the UV

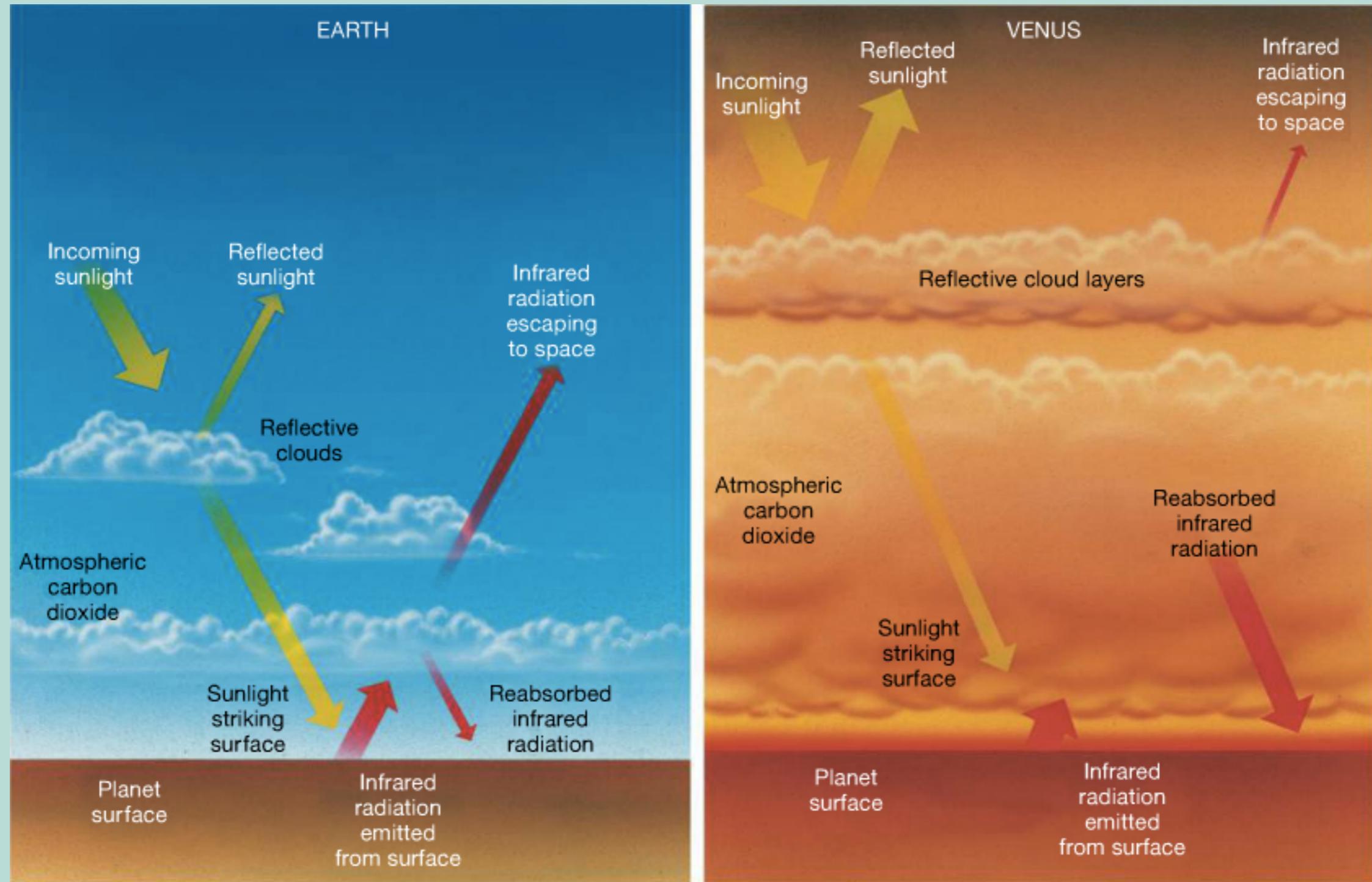
(a)



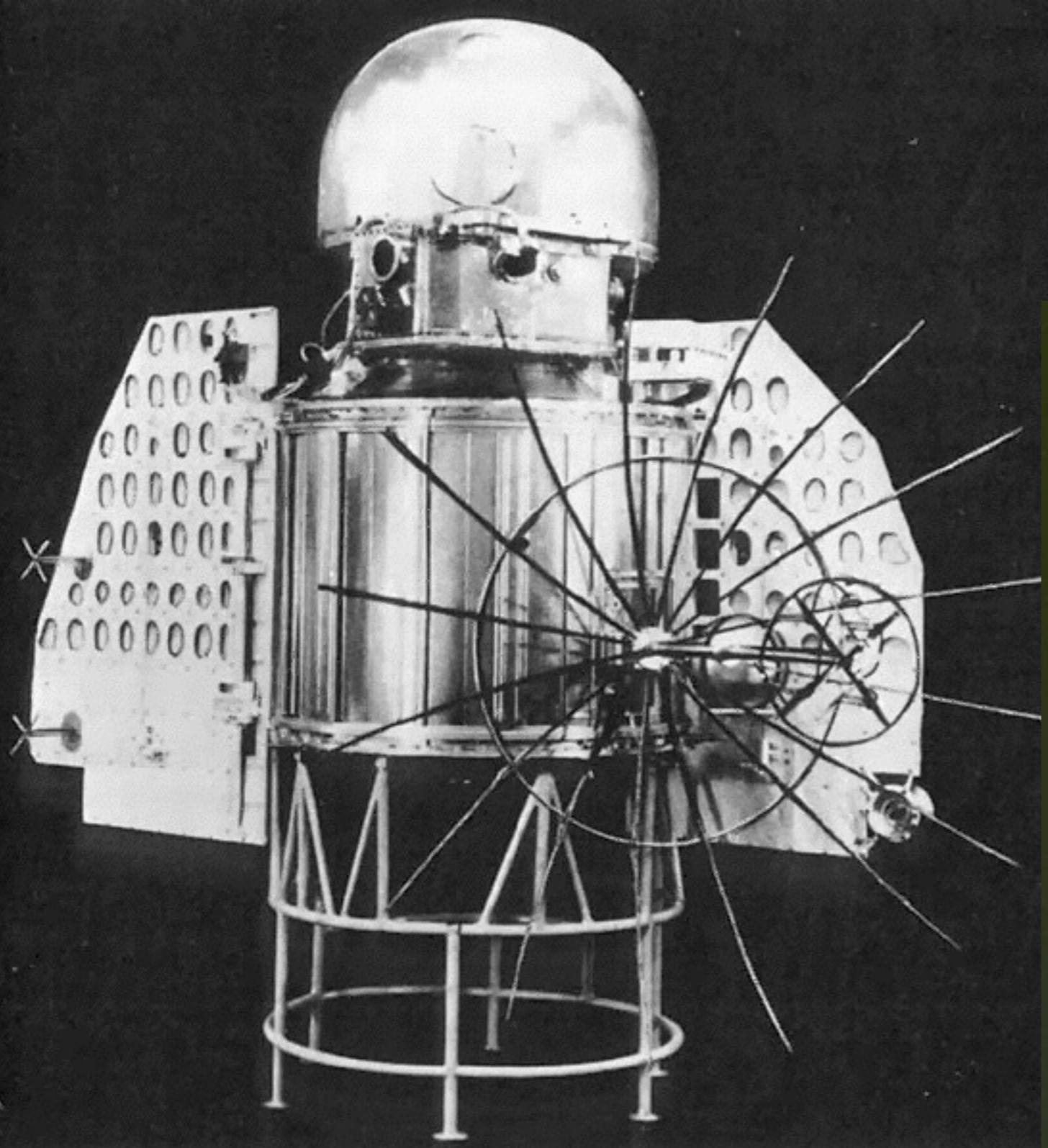
Venus in the IR



The Greenhouse Effect Revisited



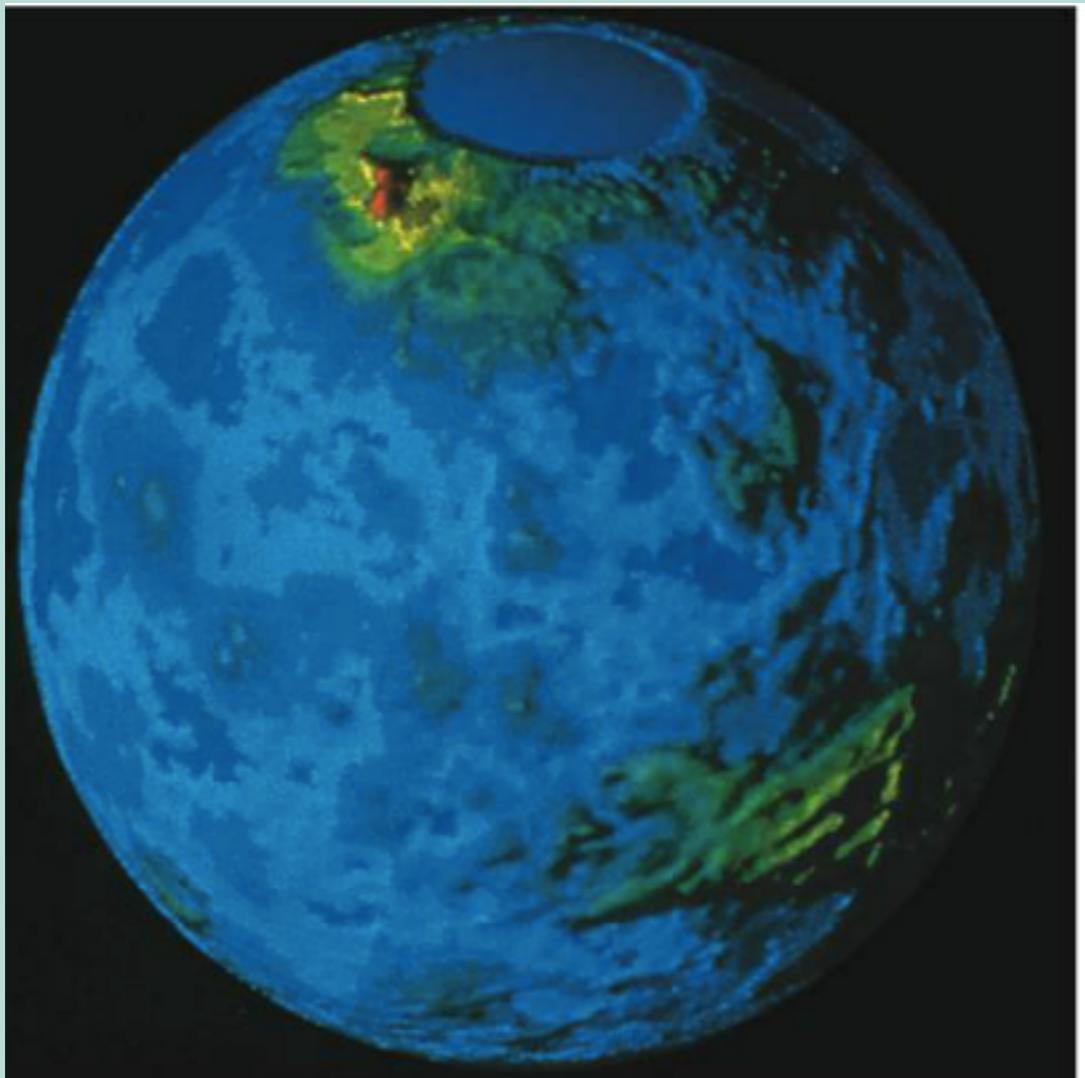
Venera 1



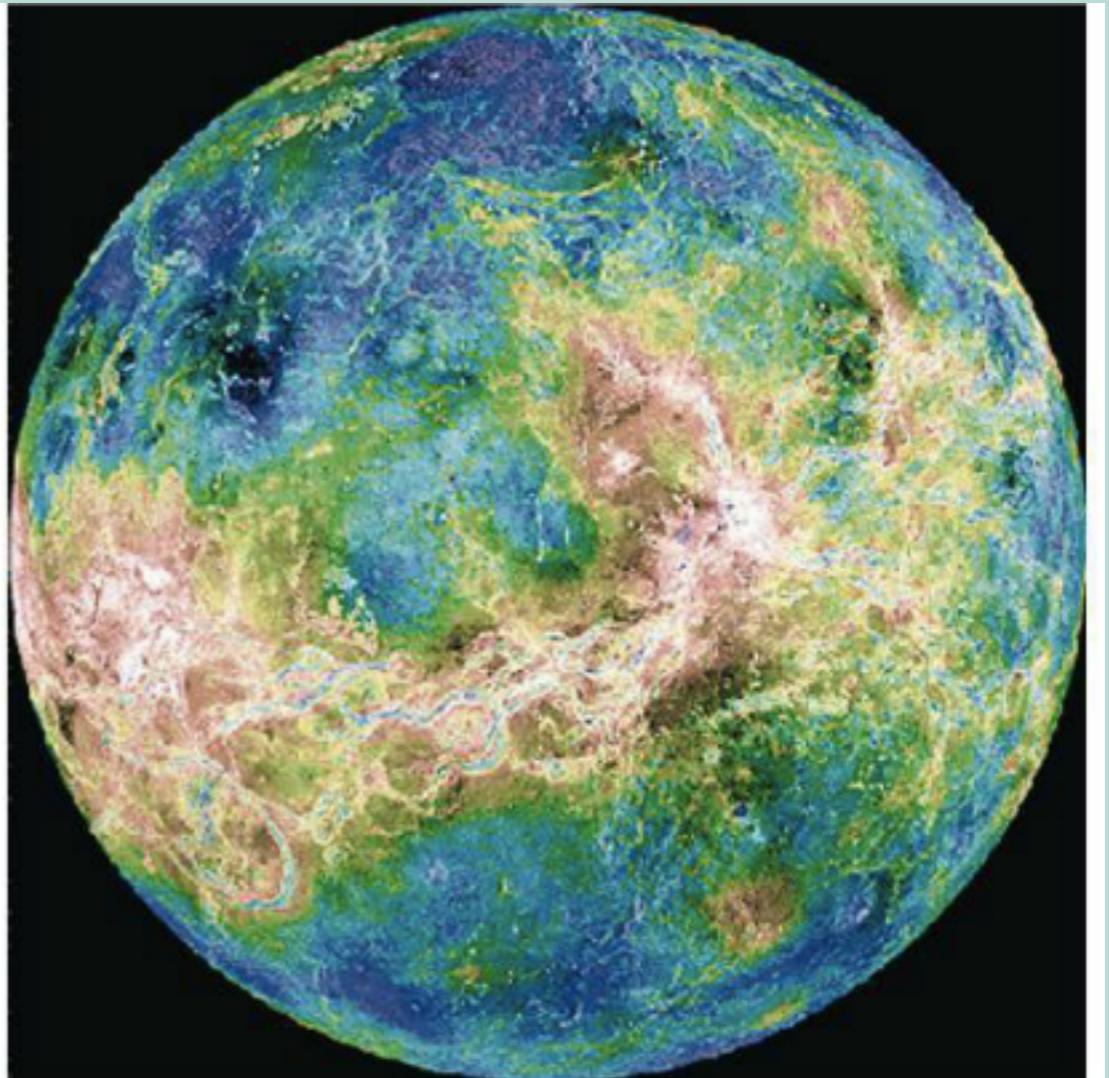
Pioneer 1



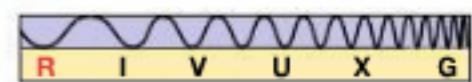
Pioneer Radargraph



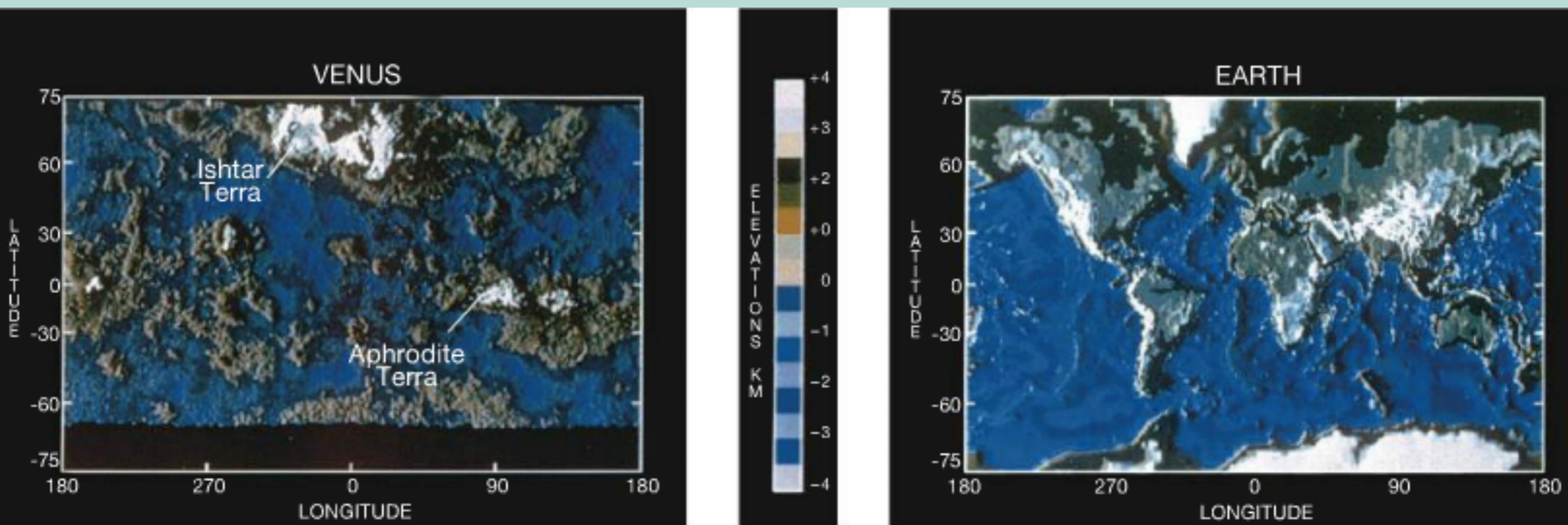
(a)

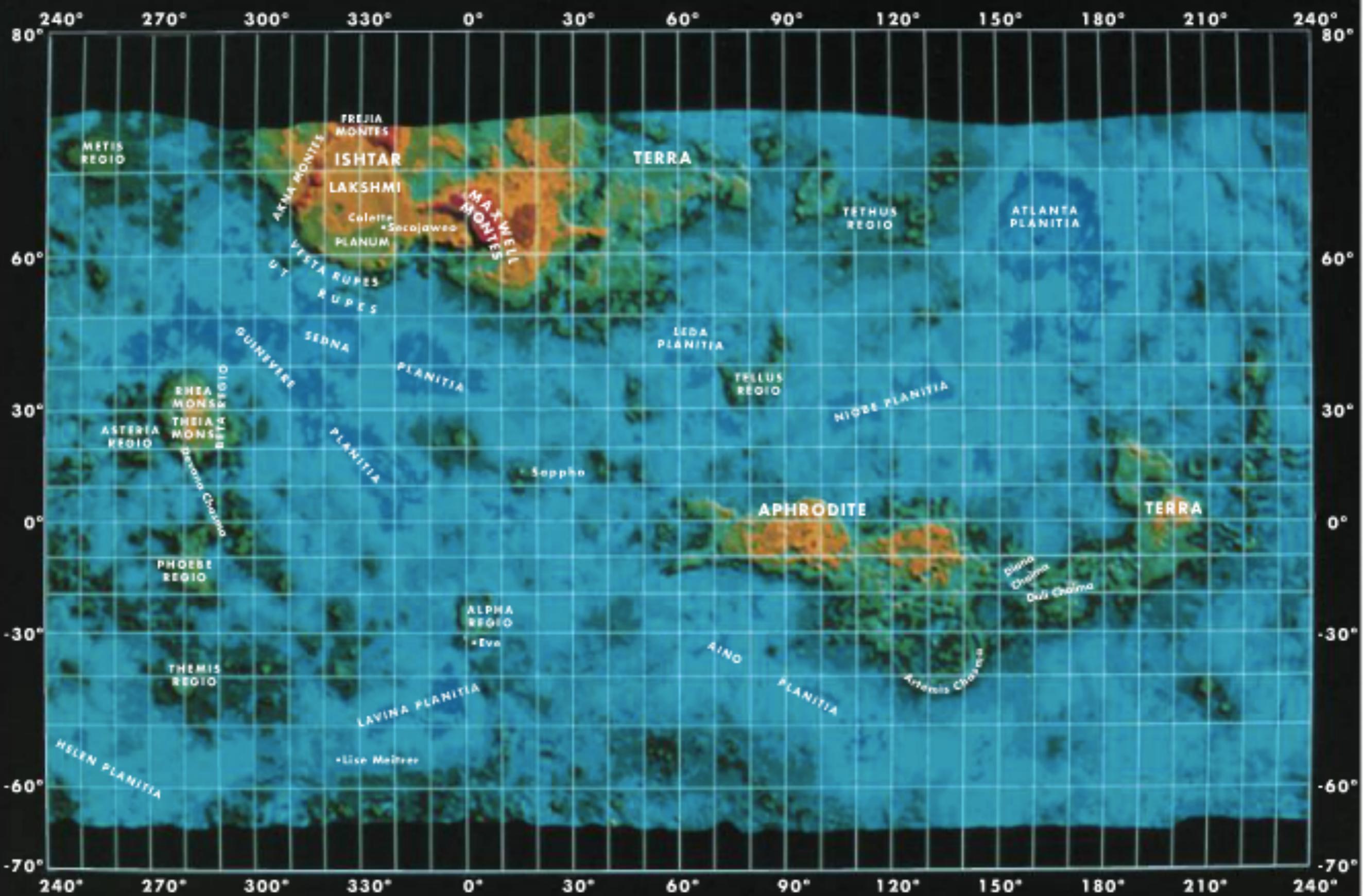


(b)



Topographical Comparison

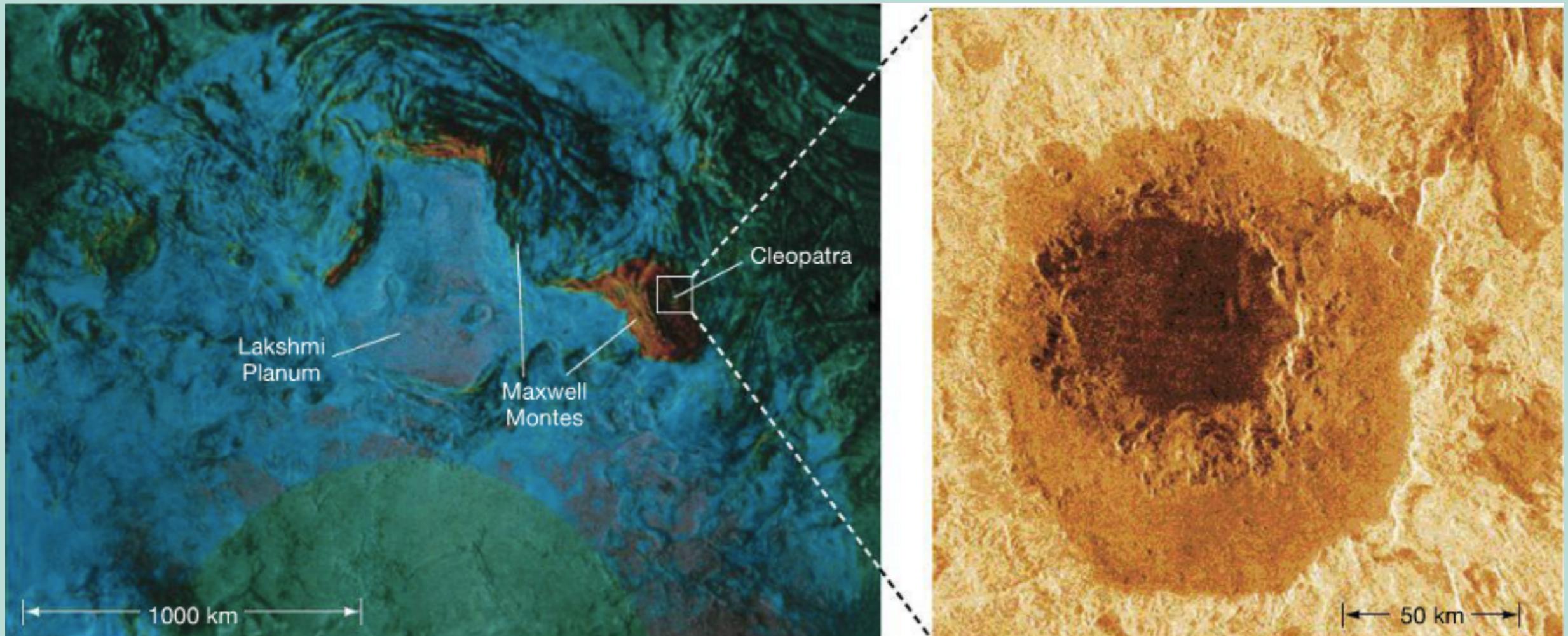




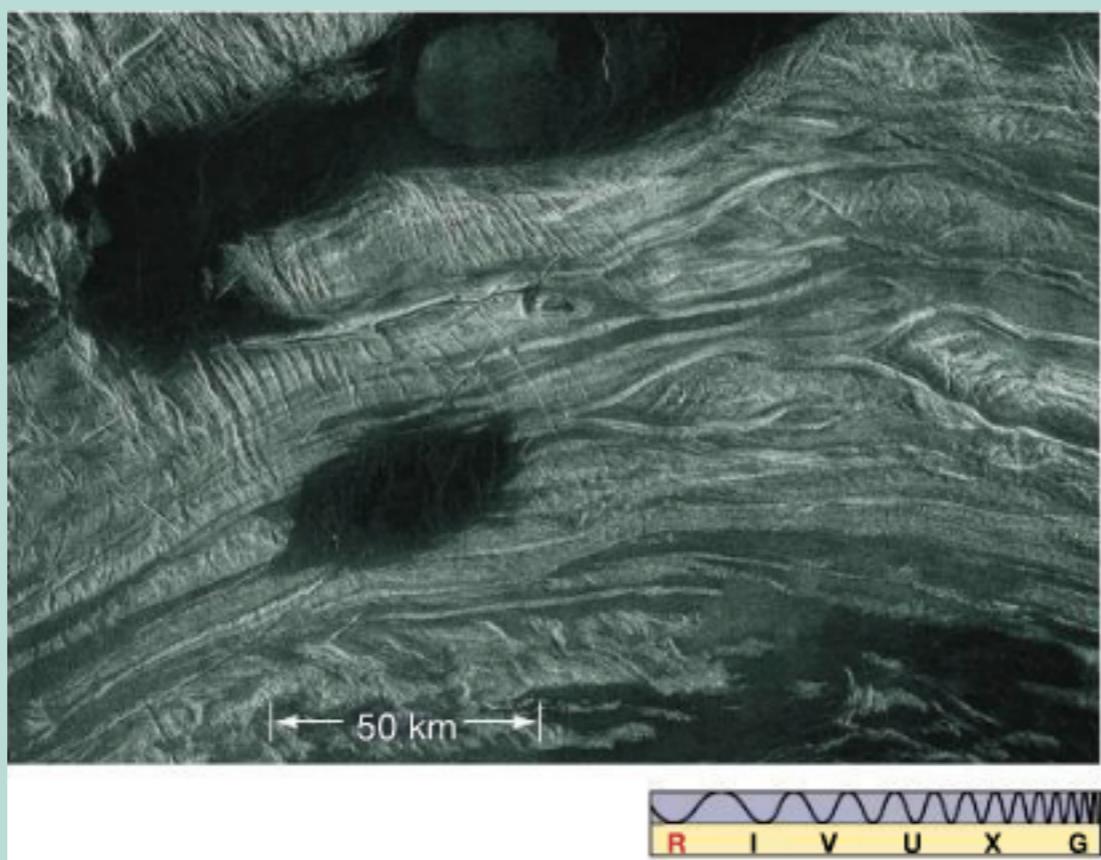
(C)



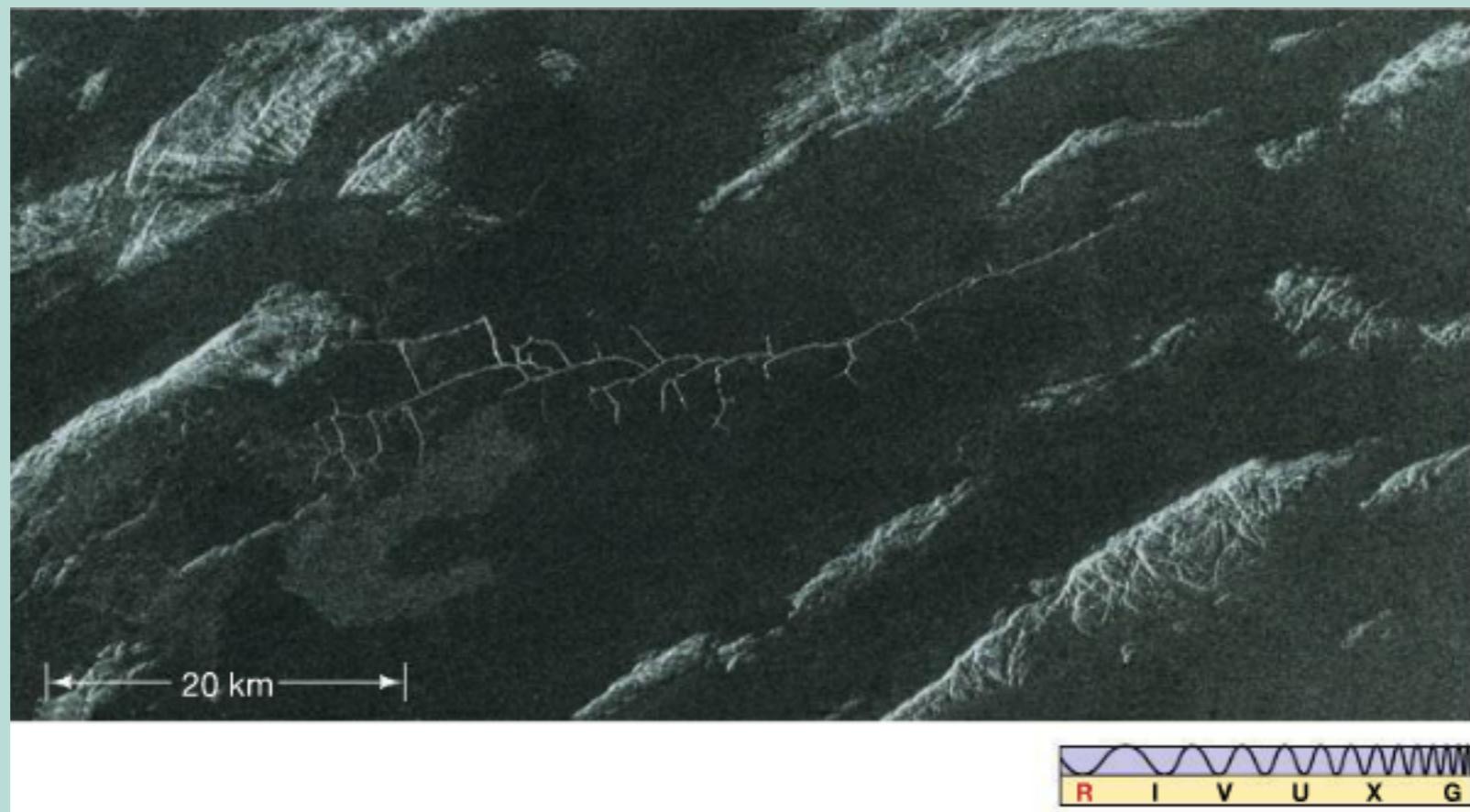
Evidence of Volcanism



Lava Rivers



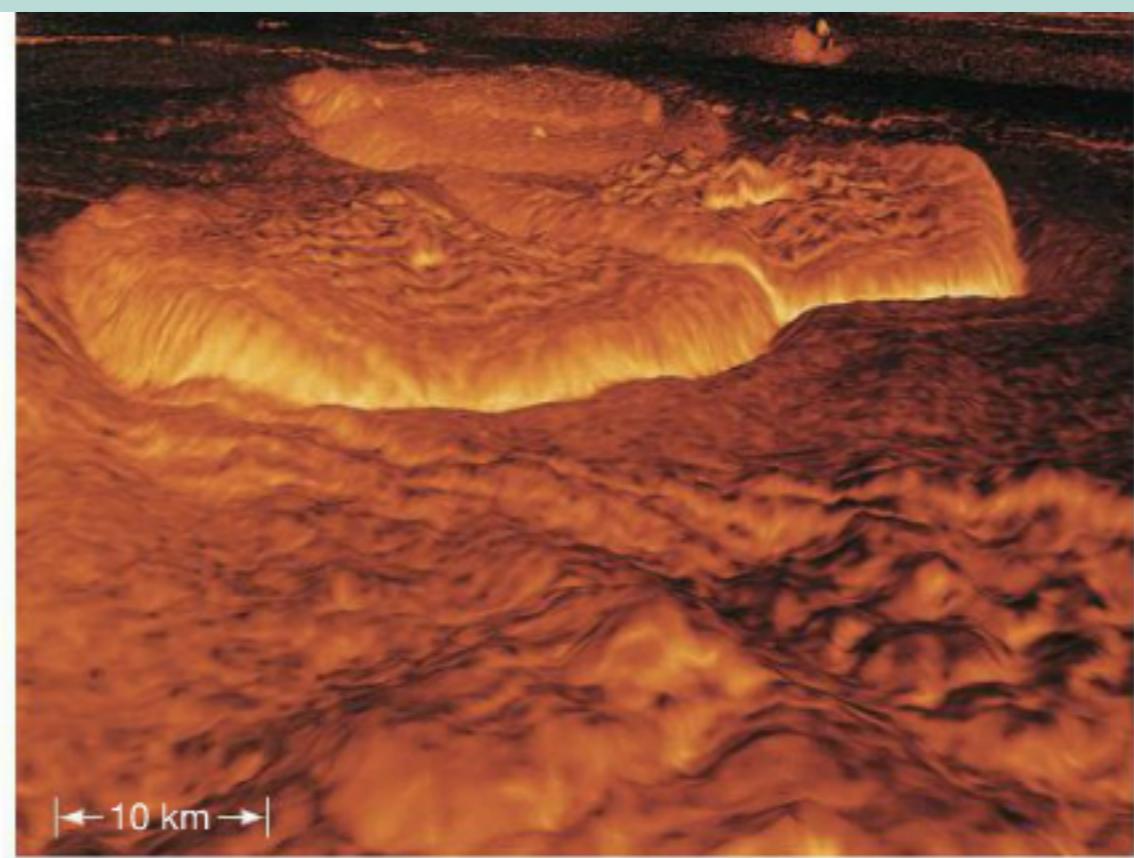
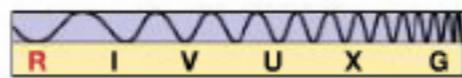
Lava Rivers



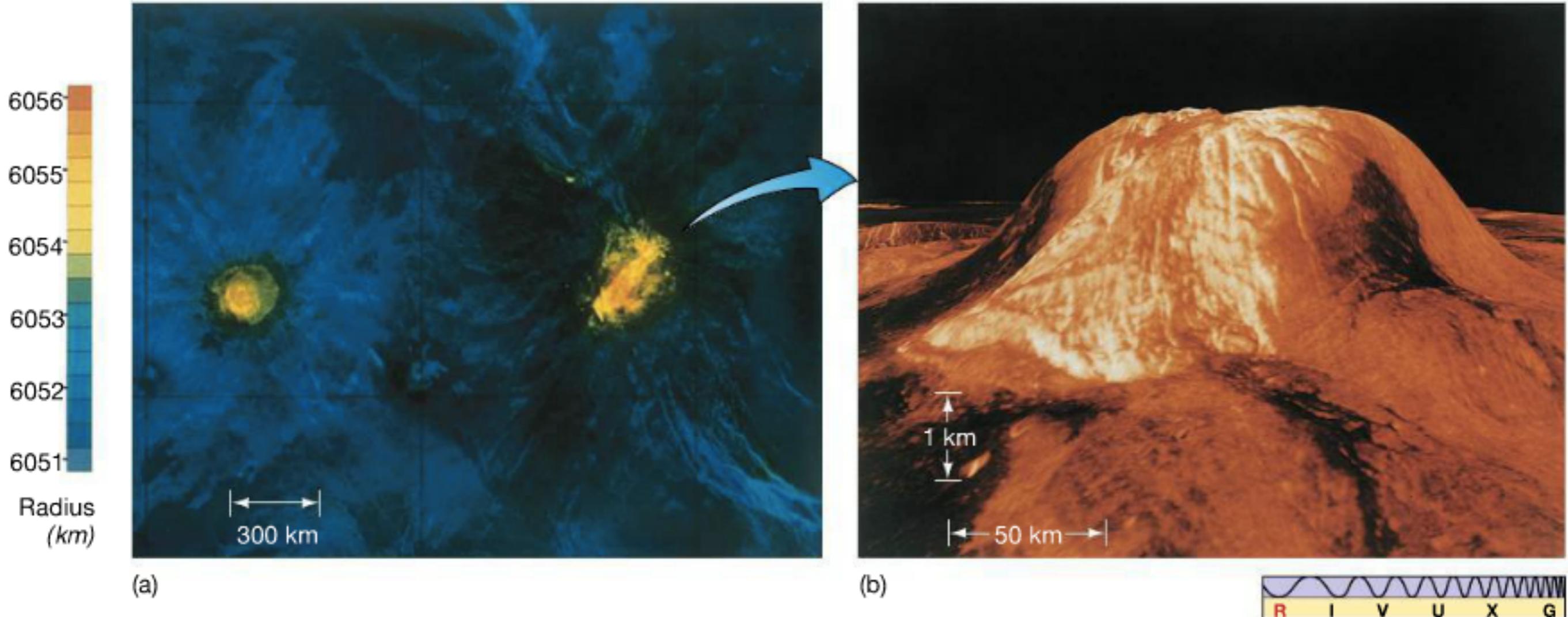
Lava Domes and Calderas



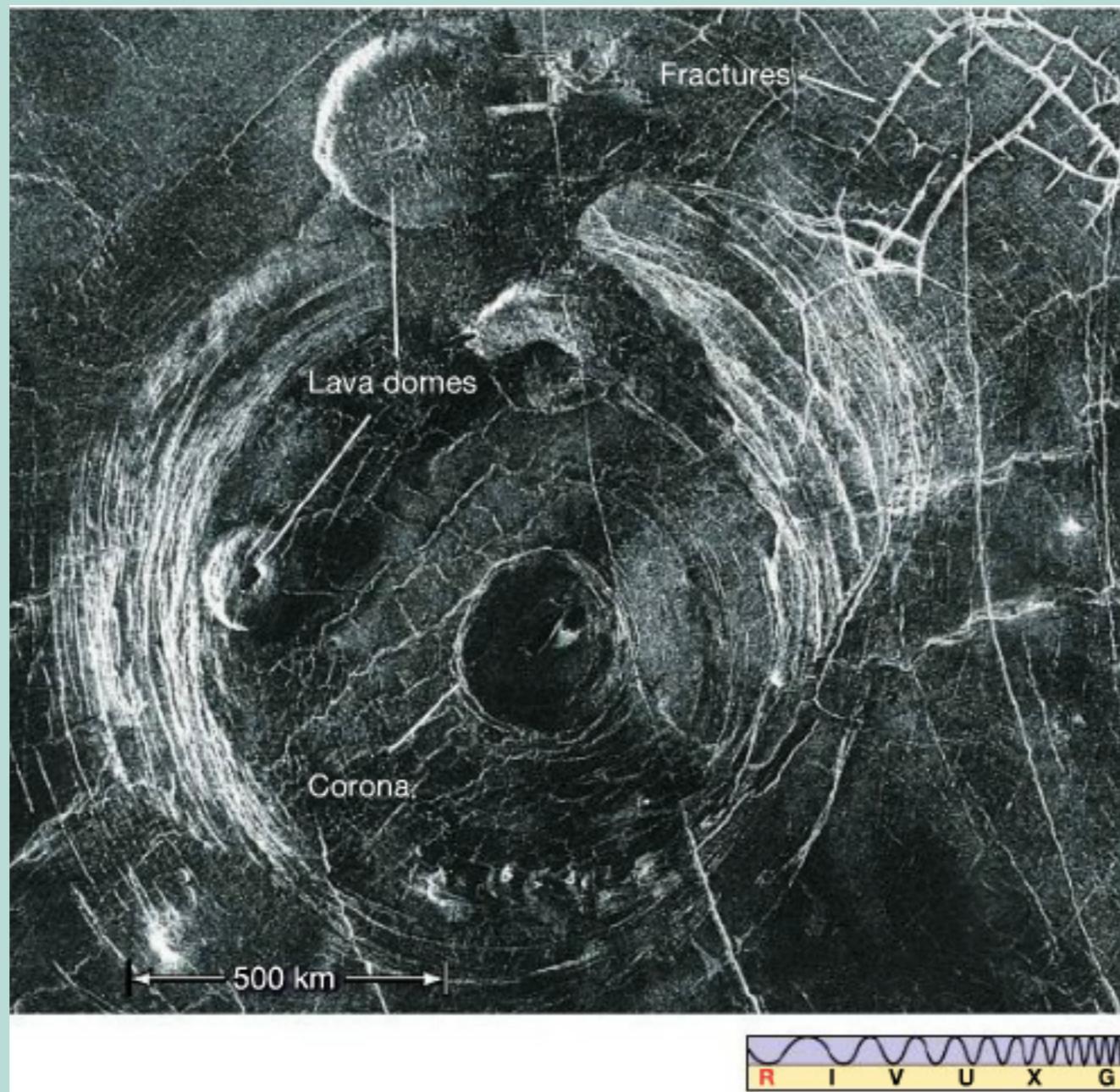
(a)



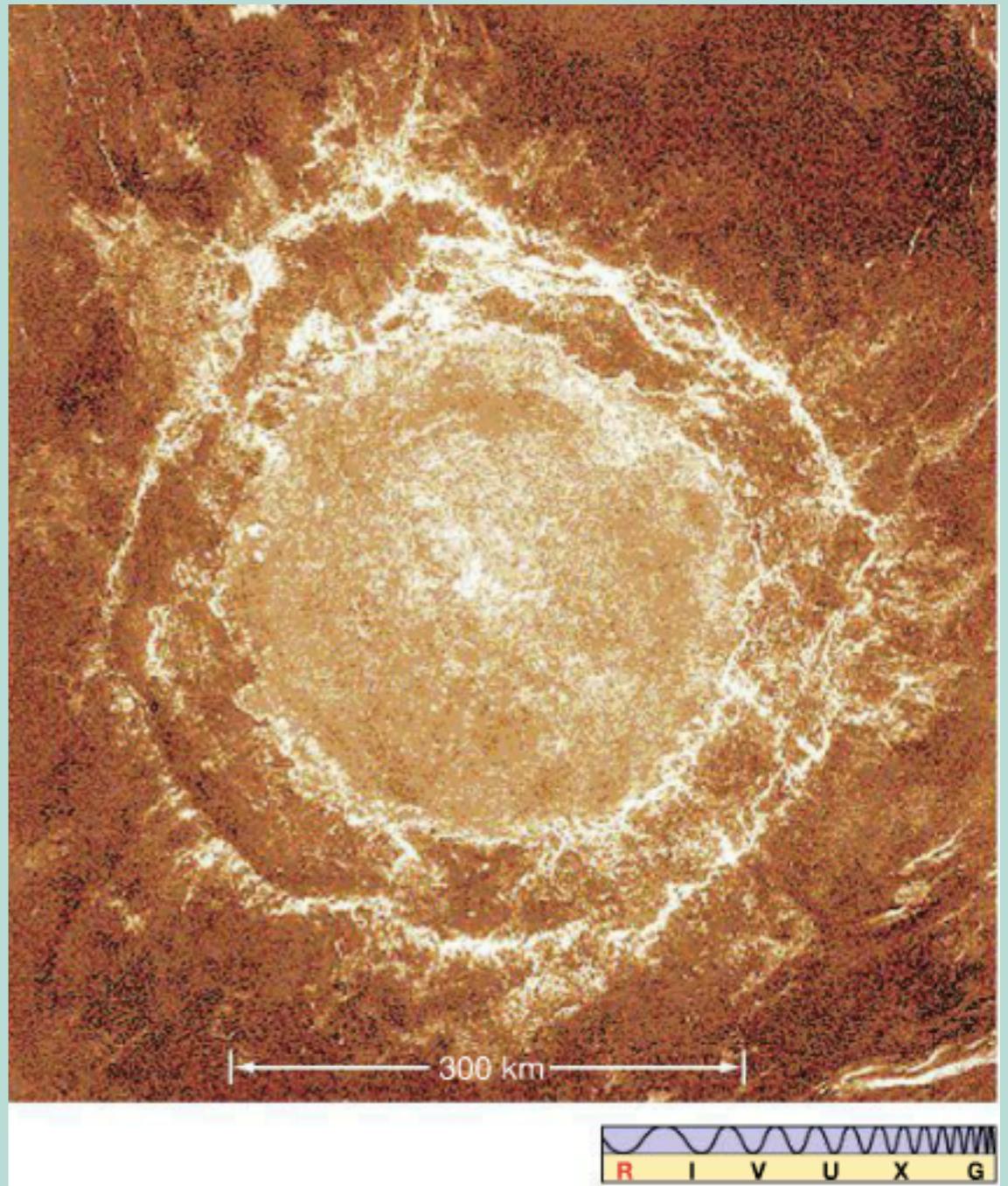
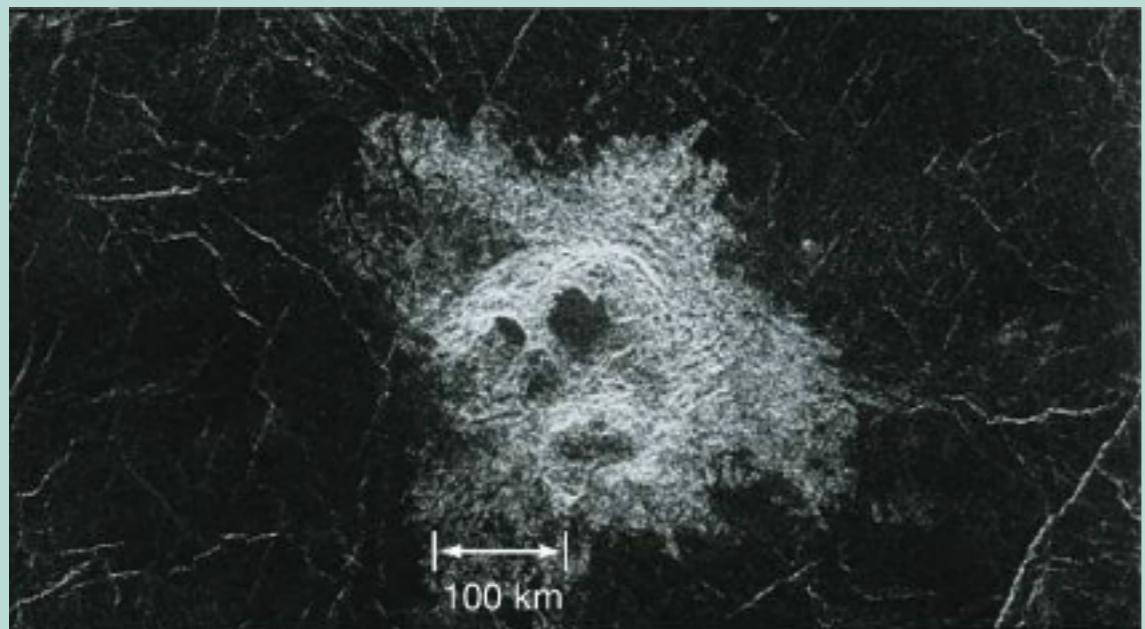
Lava Domes

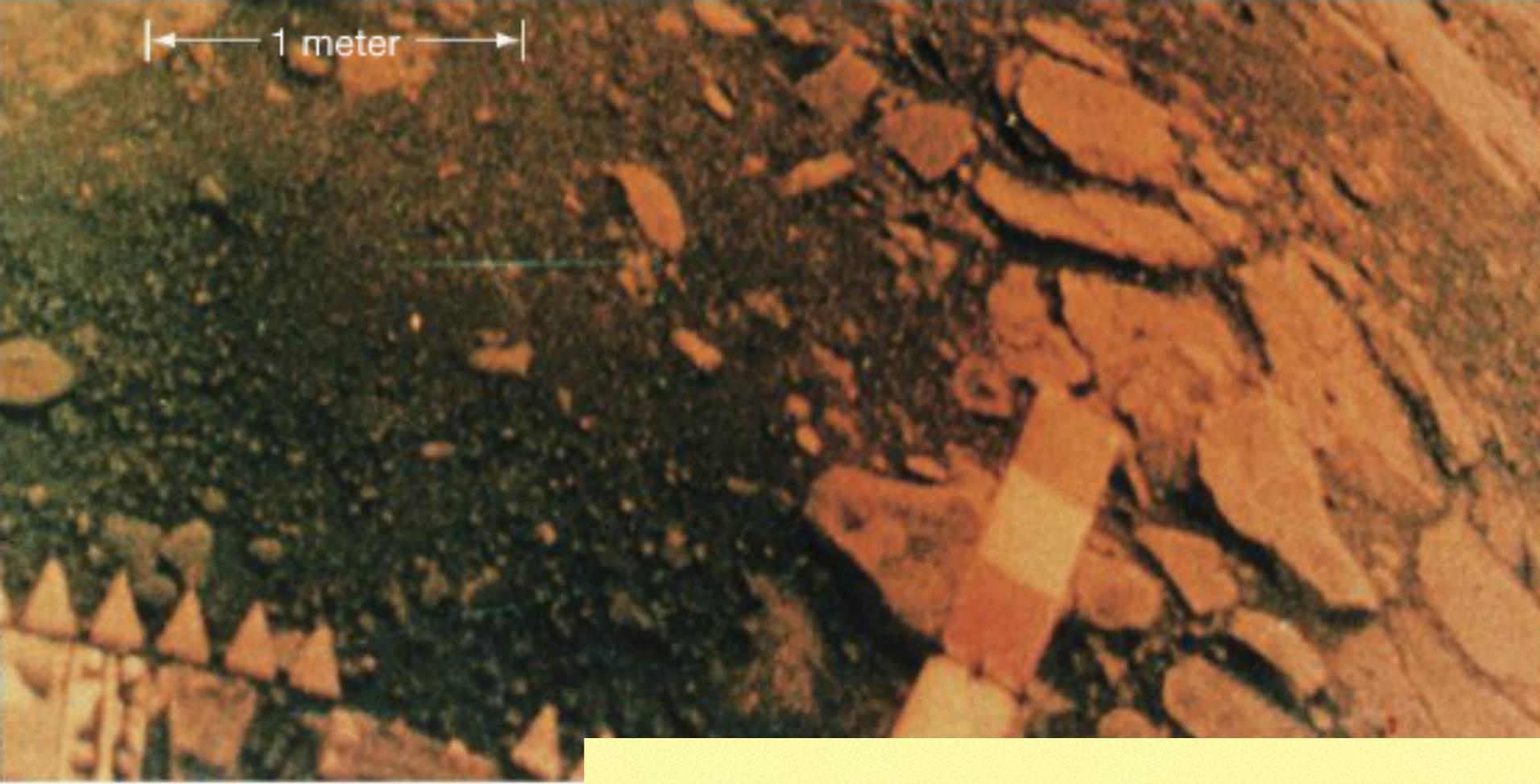


No plate tectonics, but plenty of surface activity

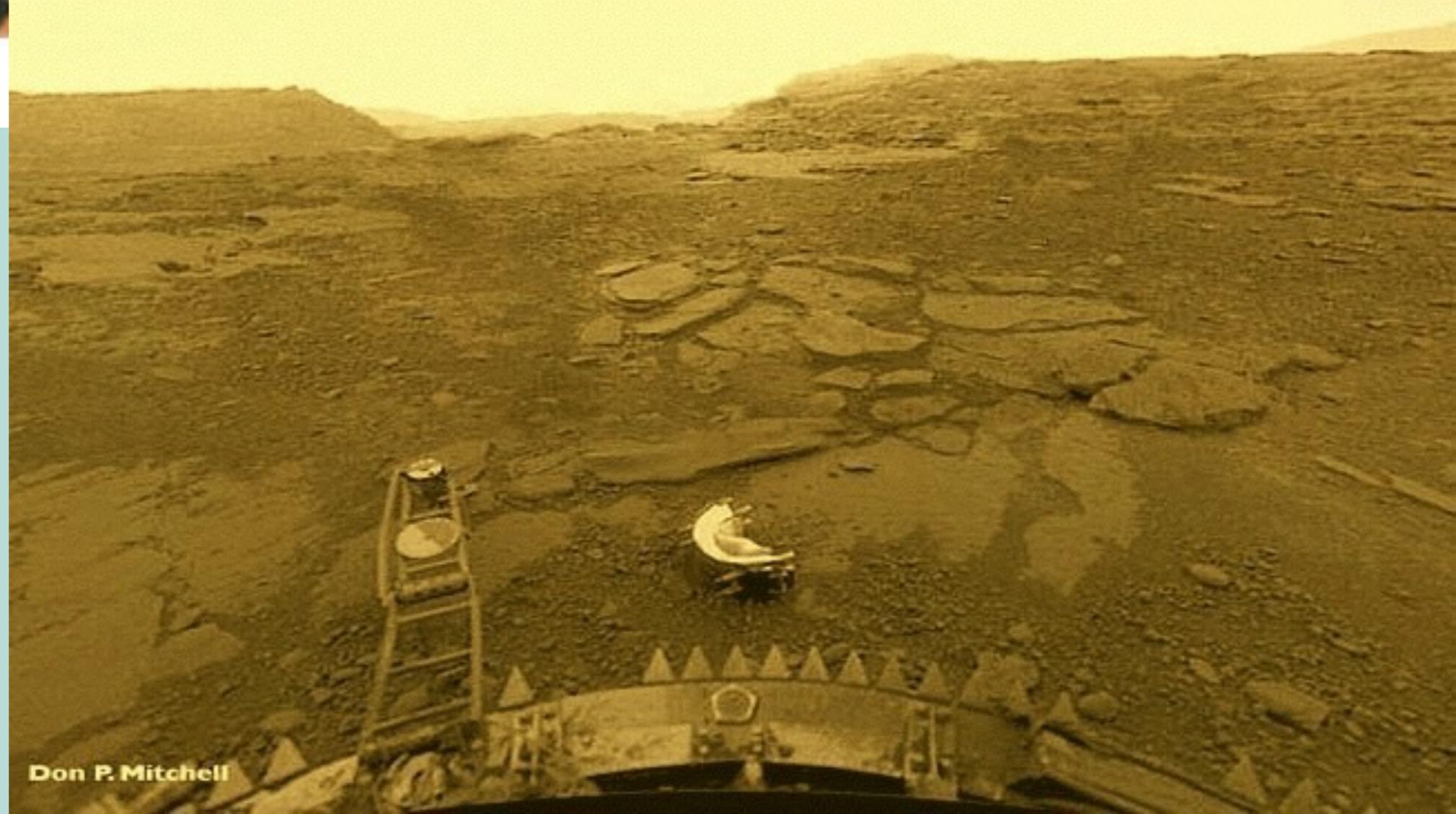


Impact Craters





(b)



Don P. Mitchell

Why is Venus so different from Earth?

- The earth and venus had similar early atmospheres so how did they diverge?
- Earth: Sunlight splits nitrogen-rich compounds releasing N into the air. Meanwhile water condenses into oceans and CO₂ and SO₂ dissolve into the oceans. Remaining CO₂ combines with surface rocks.
- If this carbon were released, the atmosphere would be 98% CO₂, 2% N and atmospheric pressure would be 70 times larger, much like Venus.

Why is Venus so different from Earth?

- Venus on the other hand was just a little too hot and a runaway greenhouse effect begun, evaporating the oceans putting more GHGs into the atmosphere, further heating in the planet, and making it harder for oceans and rocks to absorb GHGs.
- Eventually water vapor became twice as hot in the atmosphere as it is on earth, floated to the top of the atmosphere and underwent photolysis, losing the hydrogen to atmospheric evaporation and the oxygen to other chemical compounds due to its high electronegativity, losing water on Venus forever.

Result?

