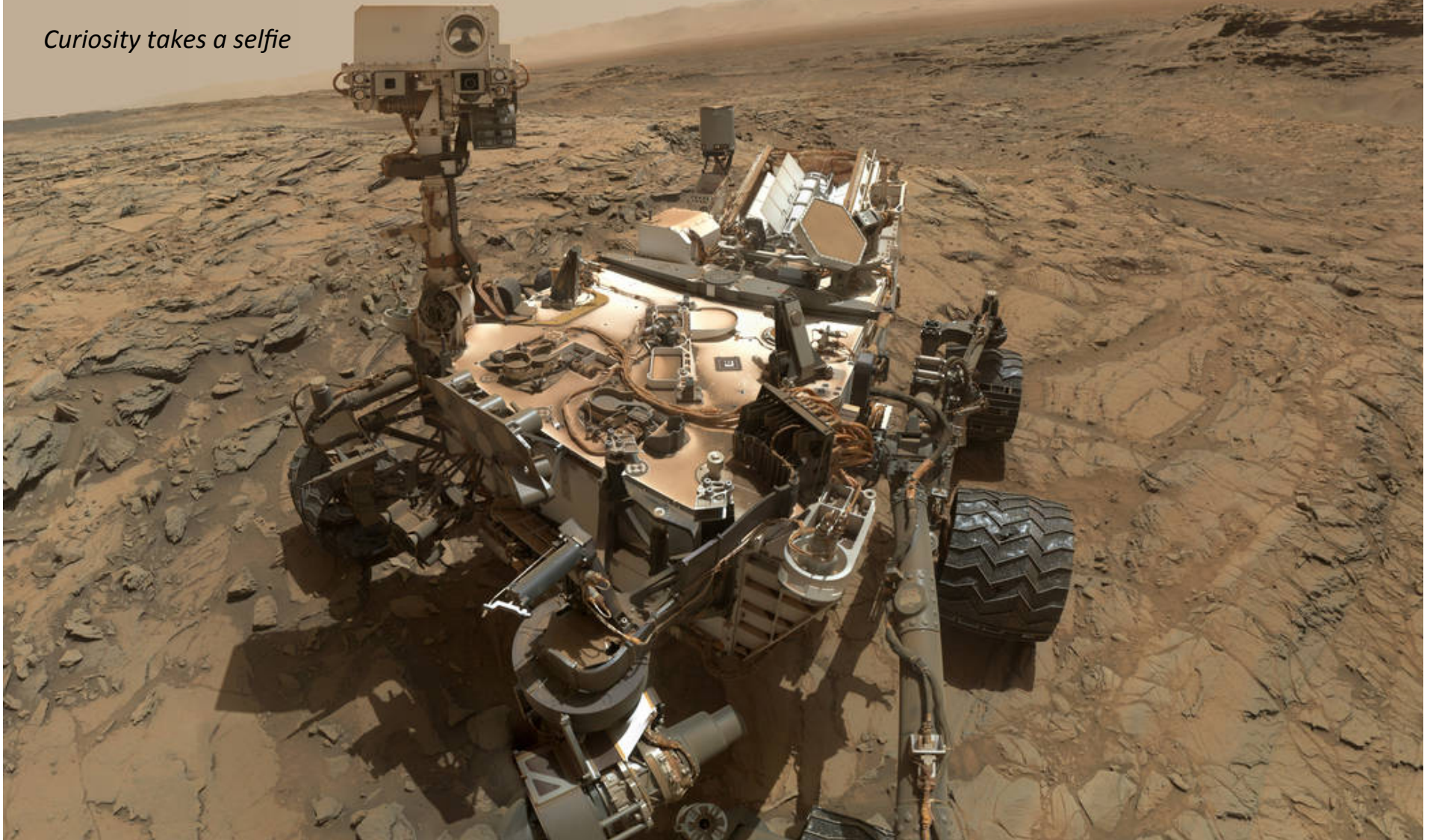


Mars Today

Tim Dowling

Professor and Director
Atmospheric Science Program
University of Louisville

Curiosity takes a selfie



Mars Yesterday



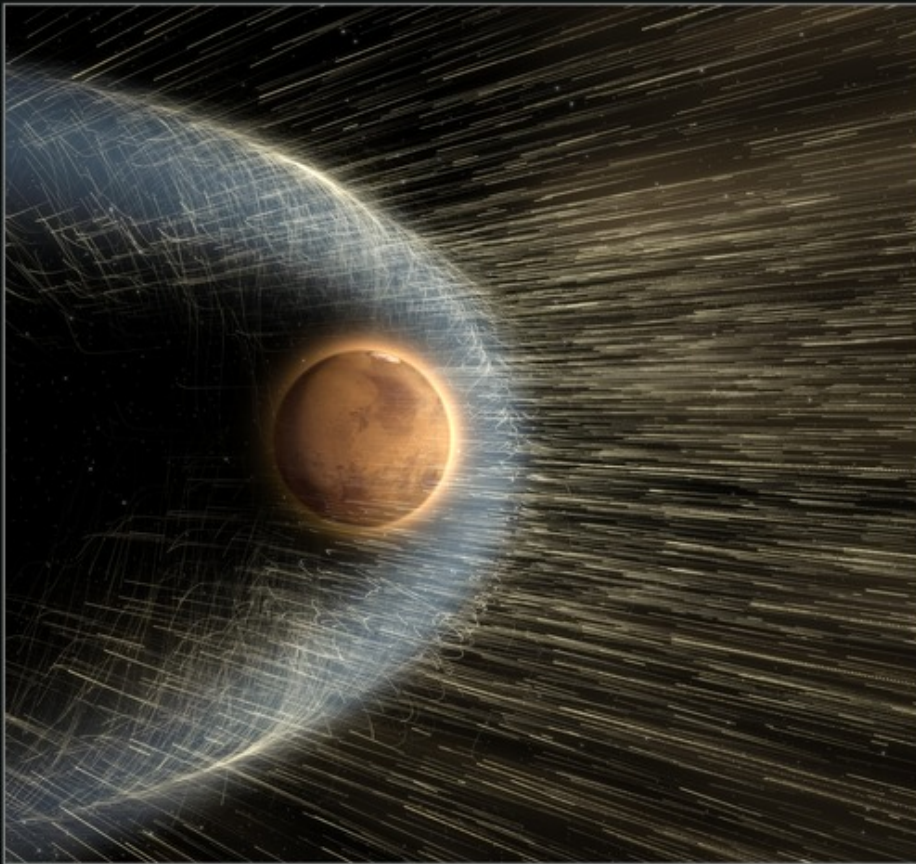
© 1940 Loew's Inc.

The Planet Mars as depicted in
the 1940 MGM cartoon "The Milky Way"

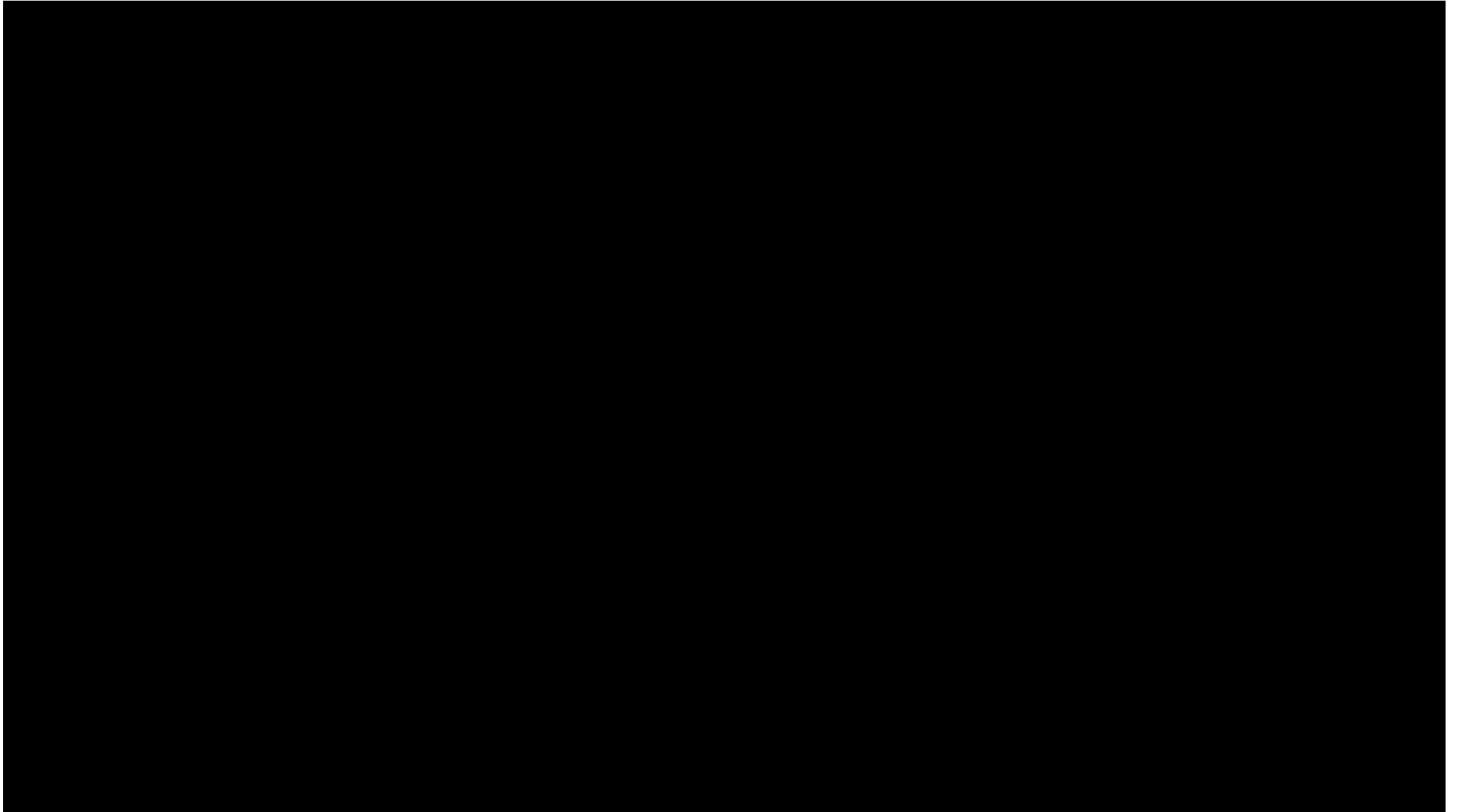
Mars Yesterday

The atmosphere of Mars lacks the protection
of a strong magnetic field

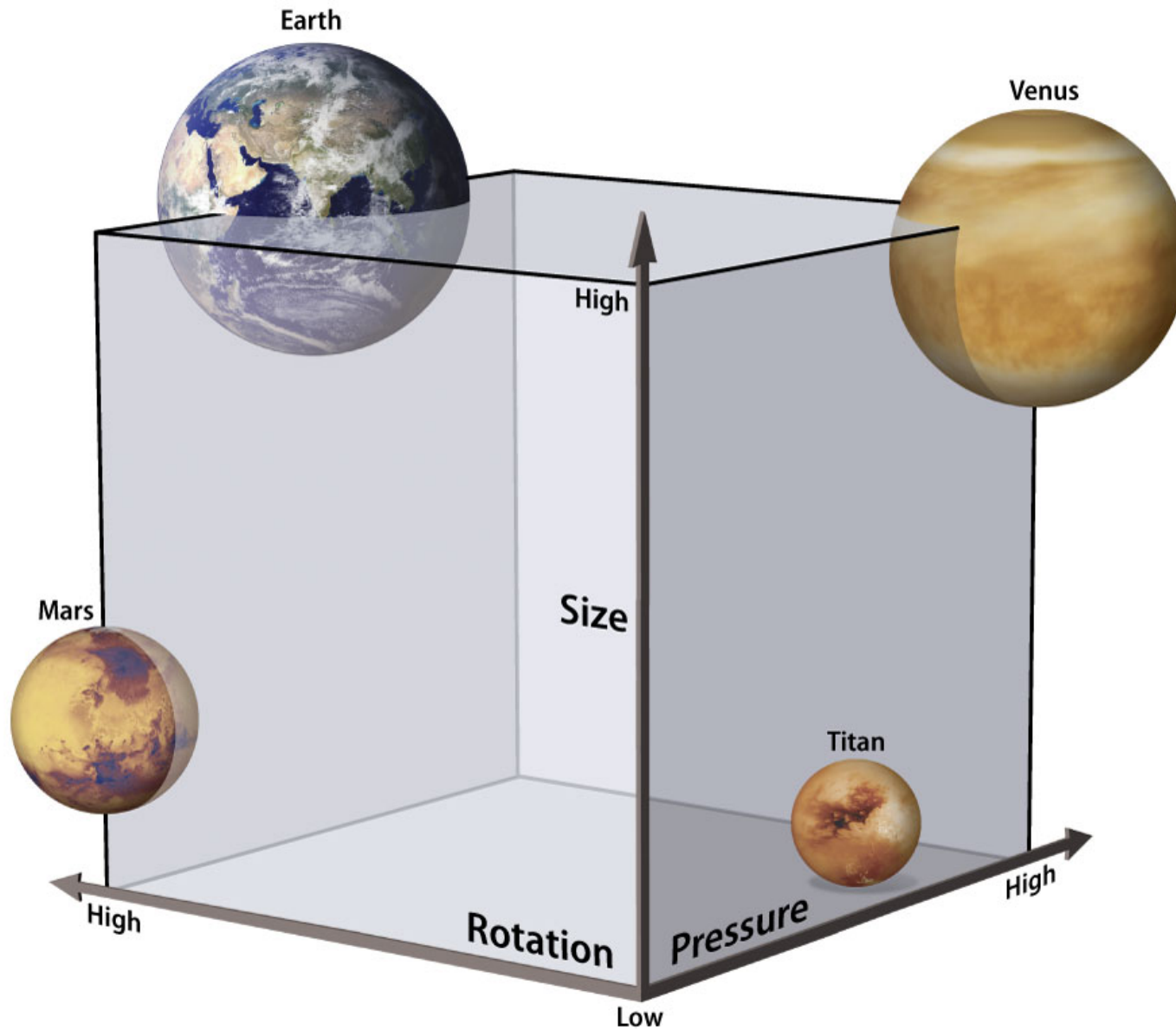
Earth's magnetic field protects its atmosphere
from ablation by the solar wind

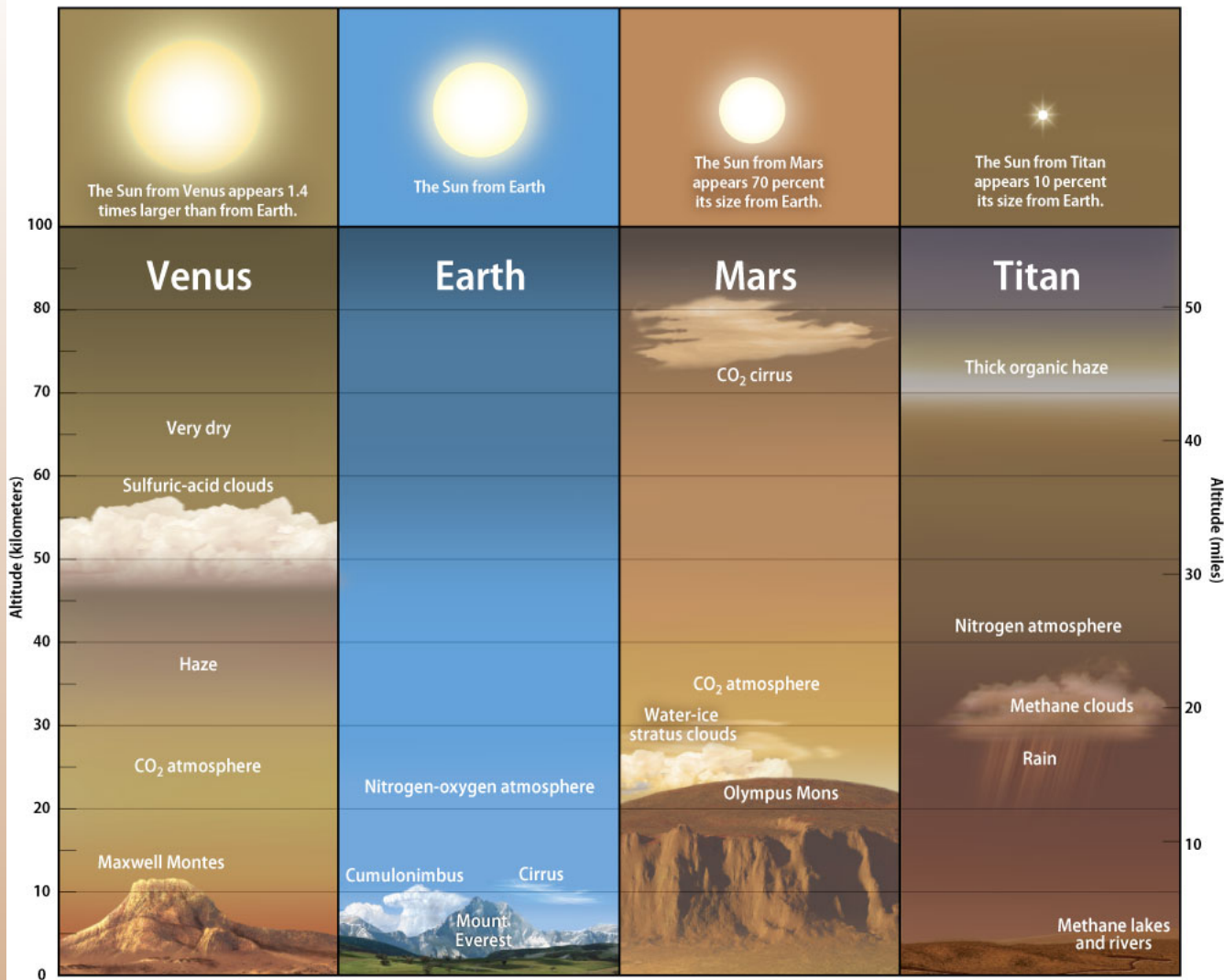


Mars Yesterday



Mars Today





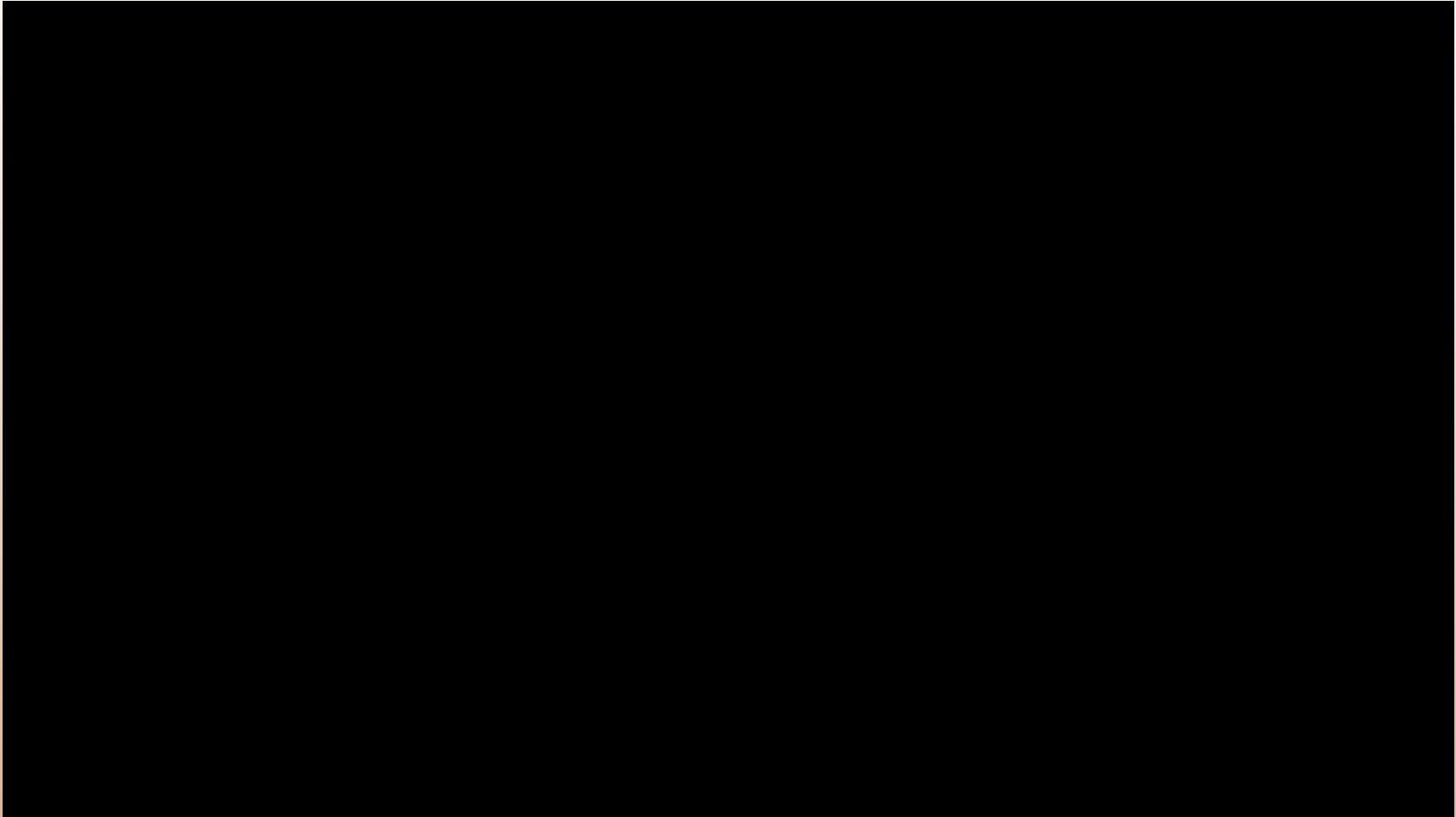
Mars lacks a big moon like Earth

No “Happy as a clam at high tide”

But it does have 2 captured asteroids, *Phobos* and *Deimos*



NASA at Mars



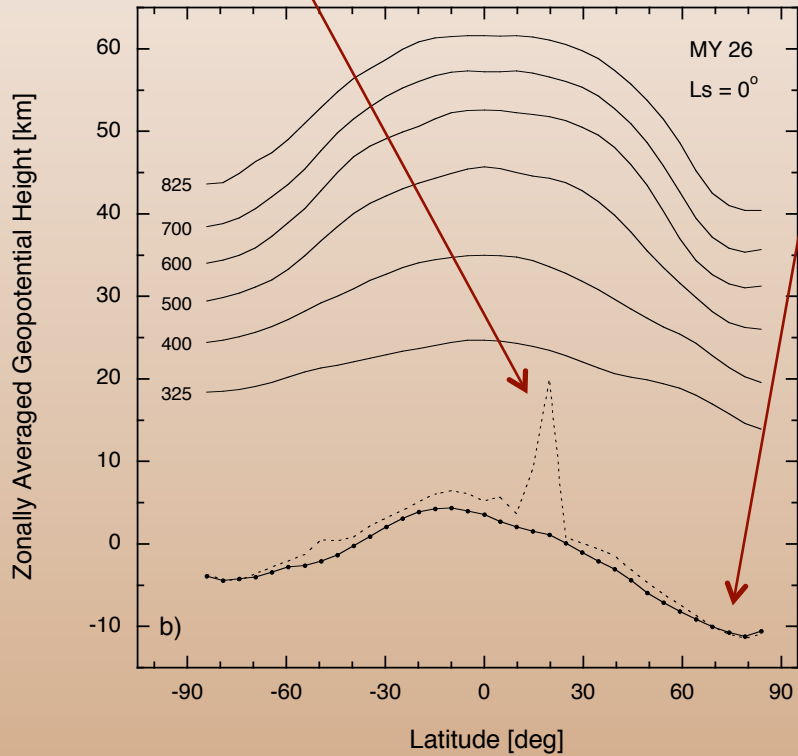
Mars Research at UofL

We are studying how the jet streams on Mars change with season

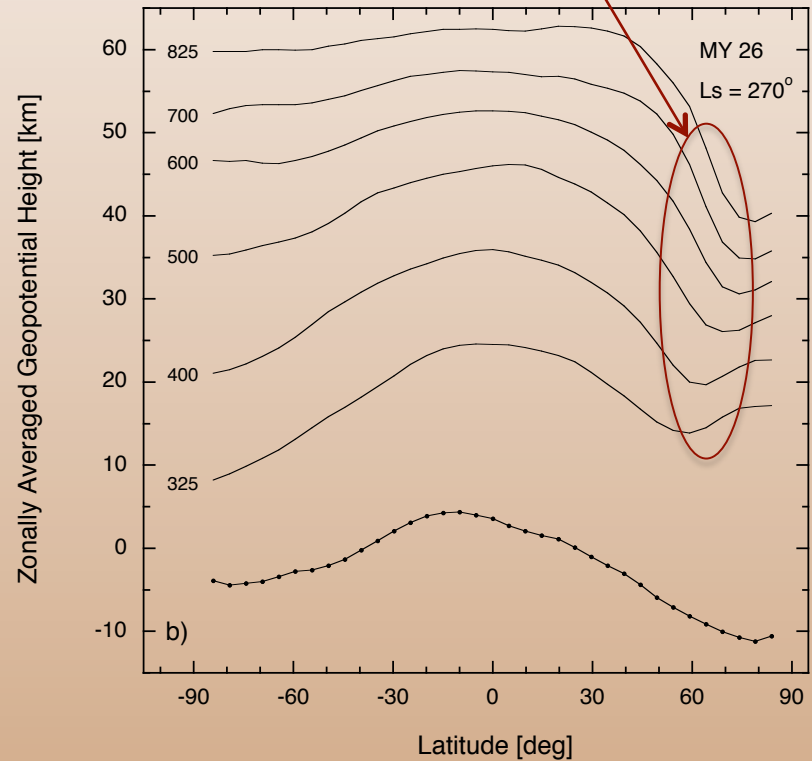
The polar jet in northern winter is the strongest ... how strong?

Olympus Mons

North Pole is below "sea level"



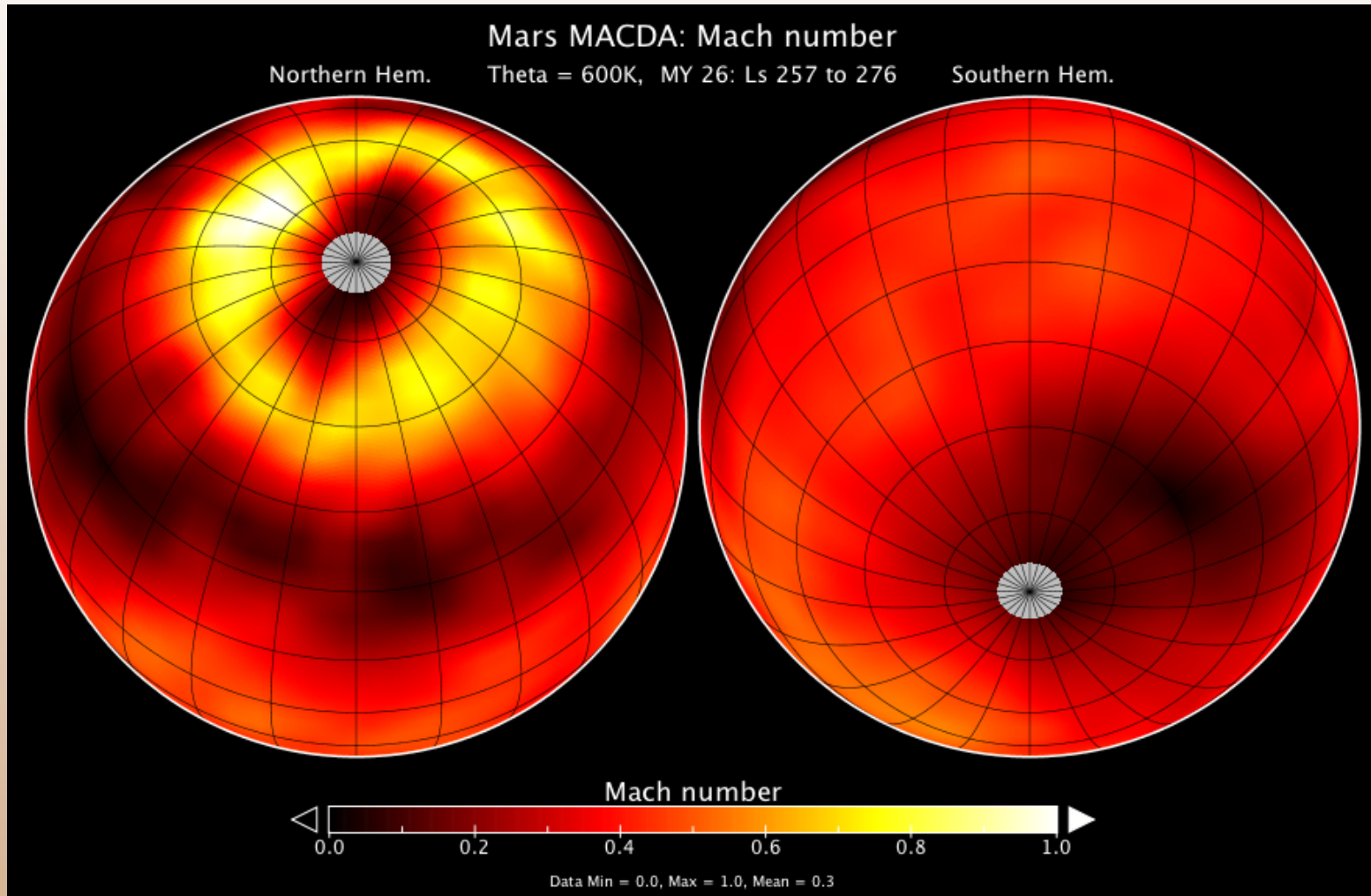
Northern Spring Mars Year 26



Northern Winter MY 26

Mars Research at UofL

Sonic jet streaks during Northern winter

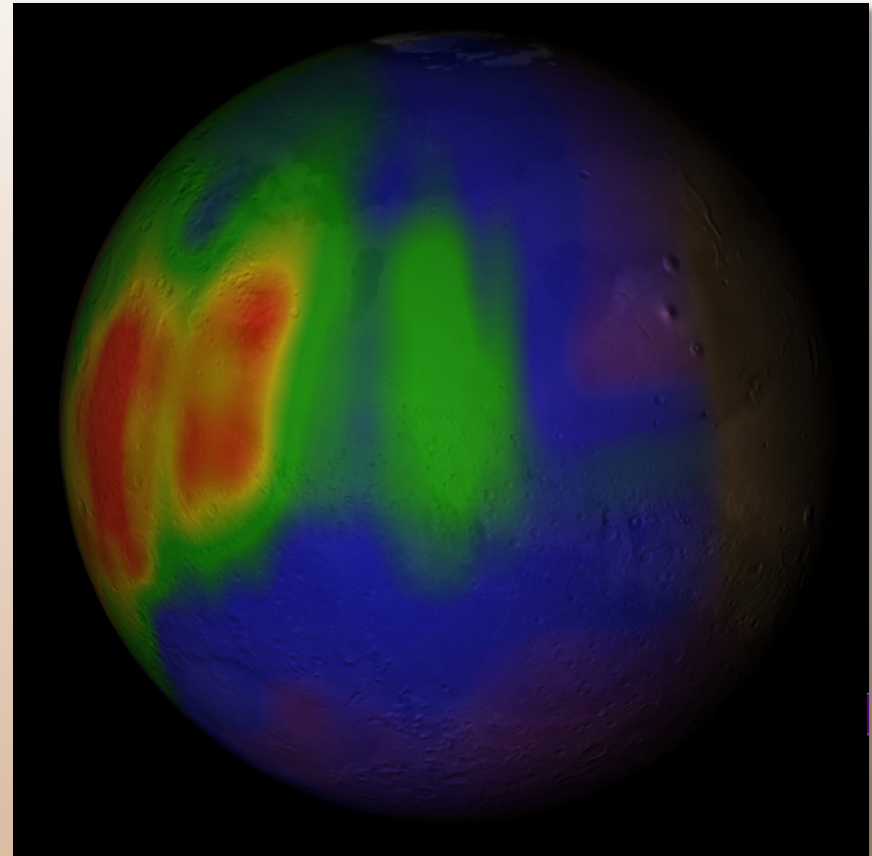


Methane on Mars

Methane gas was recently detected
in the Martian Atmosphere using
ground-based telescopes

The methane is patchy
and changes with time

Most methane in Earth's atmosphere
is produced by life, raising questions
about its origin on Mars

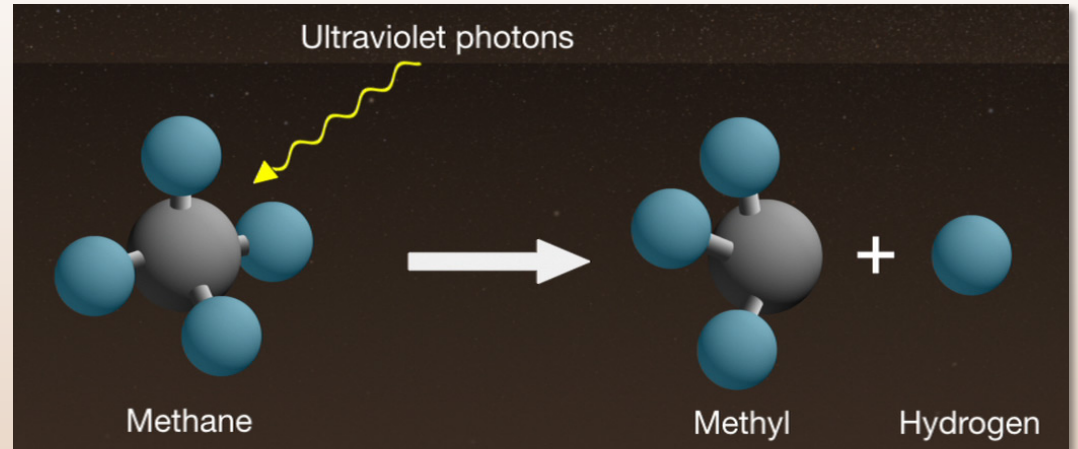


Warmer colors depict higher methane concentrations

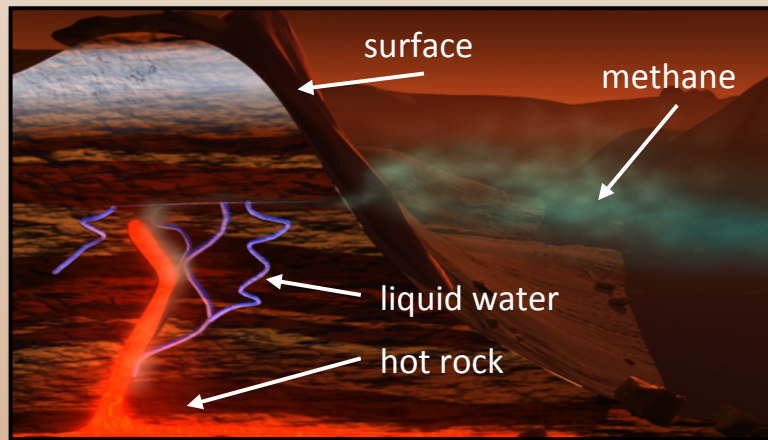
Methane on Mars

Methane in the atmosphere is destroyed by solar UV within a few hundred years

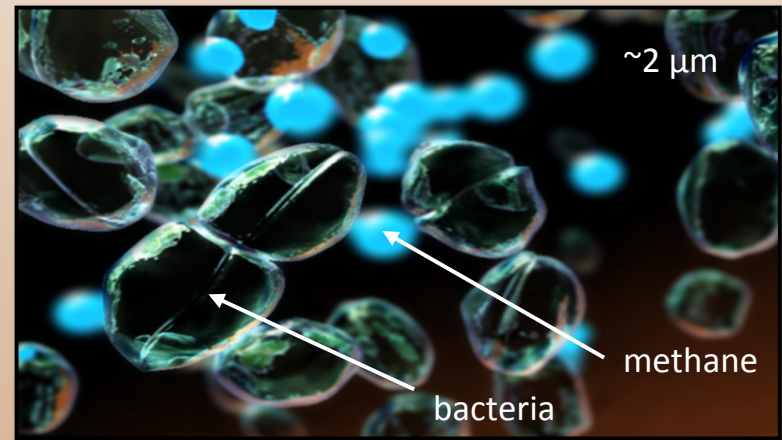
The patchiness implies methane was recently released from the subsurface



UV photodissociation of methane



Earth Analogy #1: Water-Rock Interactions



Earth Analogy #2: Bacteria

Either implies Mars' subsurface is dynamic

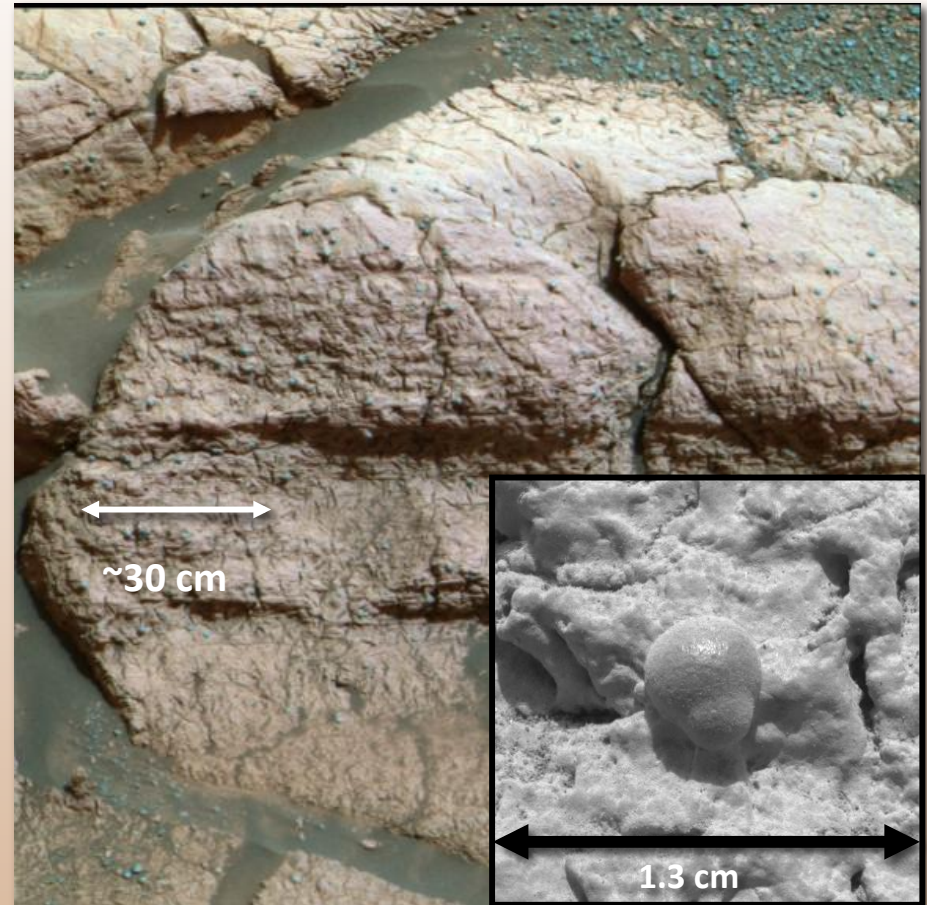
<http://dps.aas.org/education/dpsdisc/>

Sulfur Dioxide on Mars

Water on Earth leads to carbonate rocks,
like limestone

The Mars rovers are indeed finding
aqueous rocks, but instead of carbonate
they are *sulfate*

We surmise that ancient Mars had less O_2 and
water vapor to remove its SO_2 gas, leading to
geochemical differences with Earth

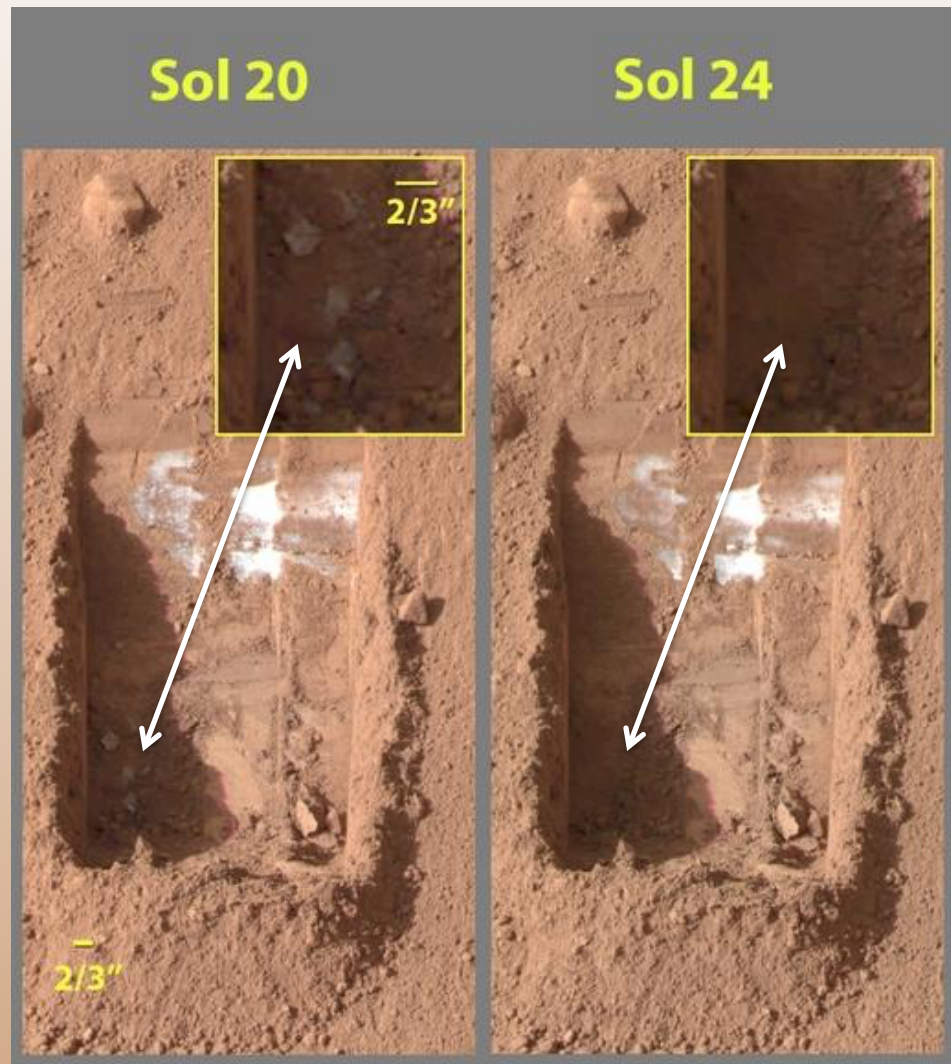


This outcrop contains the sulfur mineral *jarosite* and the inset shows a blueberry-shaped *hematite*, a sign of acid-sulfate water

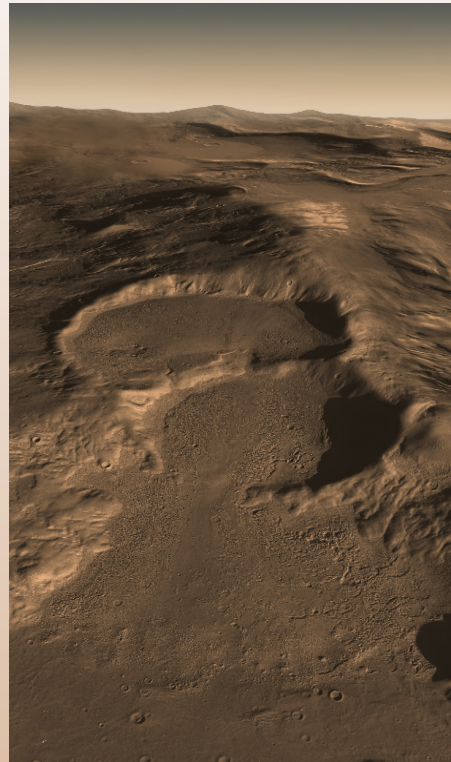
Water Ice on Mars

In 2008, NASA Mars Phoenix dug a trench and found water-ice just below the surface

A few days later, some of these ice cubes sublimated



Water Ice on Mars



Perspective view using NASA Mars Reconnaissance Orbiter (MRO) images

Radar images indicate large ice sheets under a protective layer of rock (artist conception)

<http://dps.aas.org/education/dpsdisc/>

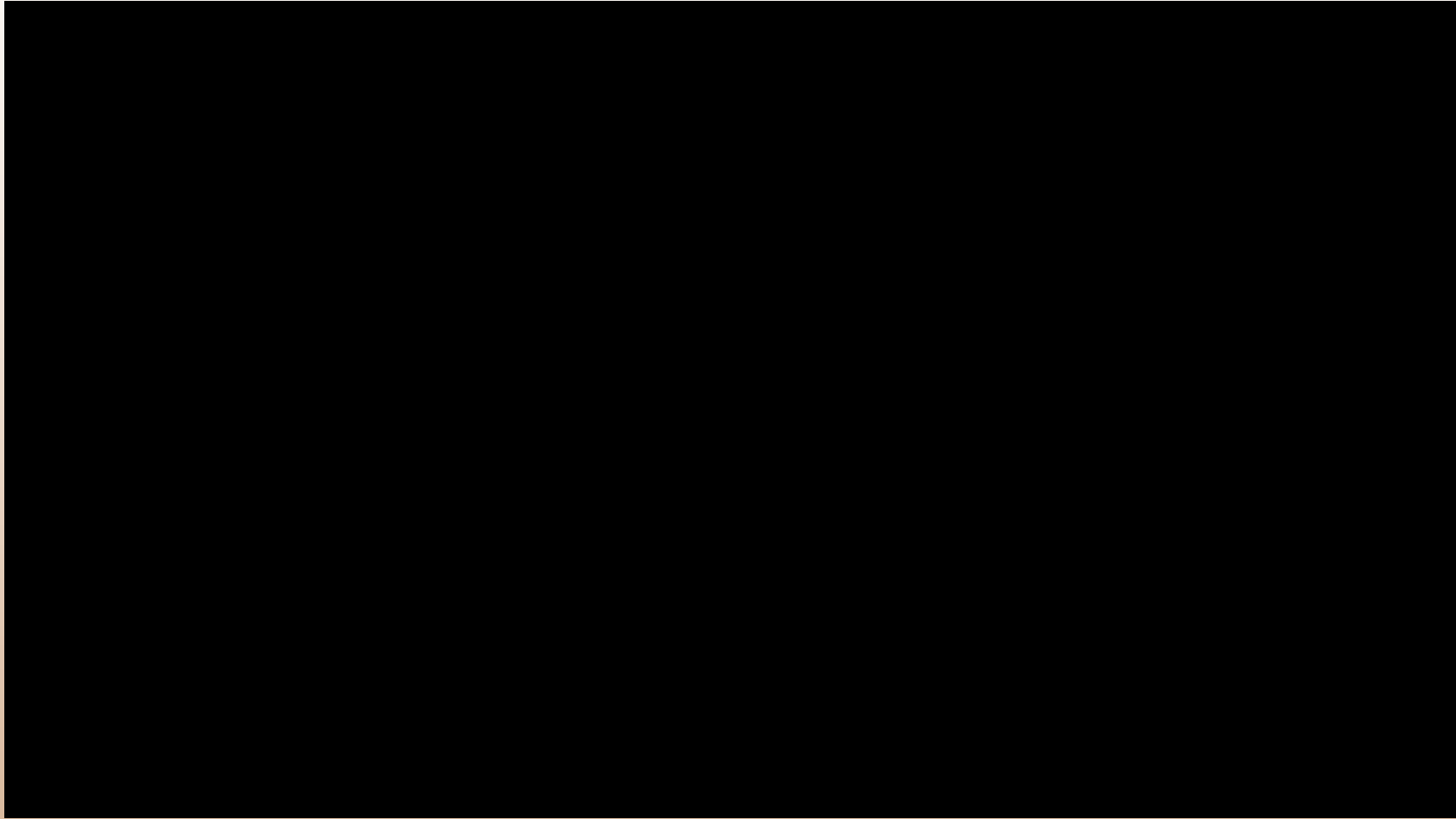
Liquid Water on Mars

All life as we know it requires a solvent

Liquid water is the most reliable solvent in the universe

- Water's liquid-temperature range is 2-3 times other solvents
- When water freezes, it floats; other solvents sink
- Water's huge heat capacity buffers temperature swings
- Water bends enzymes to catalyze biological reactions

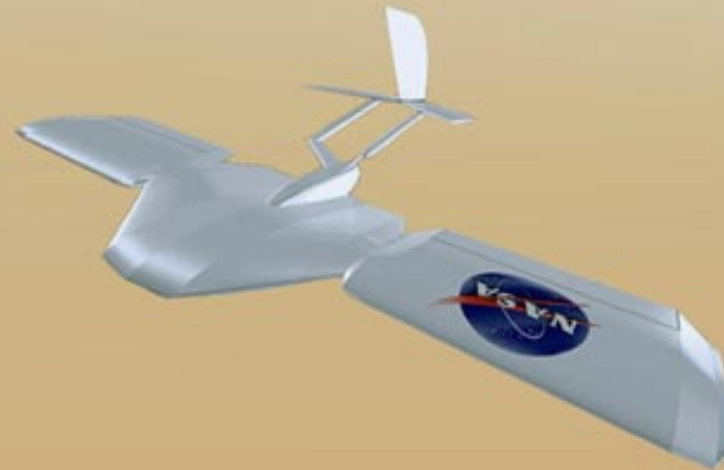
Liquid Water on Mars *Today*



In 2015, NASA confirmed by spectroscopy that these damp features contain *hydrated* salts, the smoking gun

Mars has liquid water on its surface right now.

Mars Tomorrow



Mars Tomorrow

