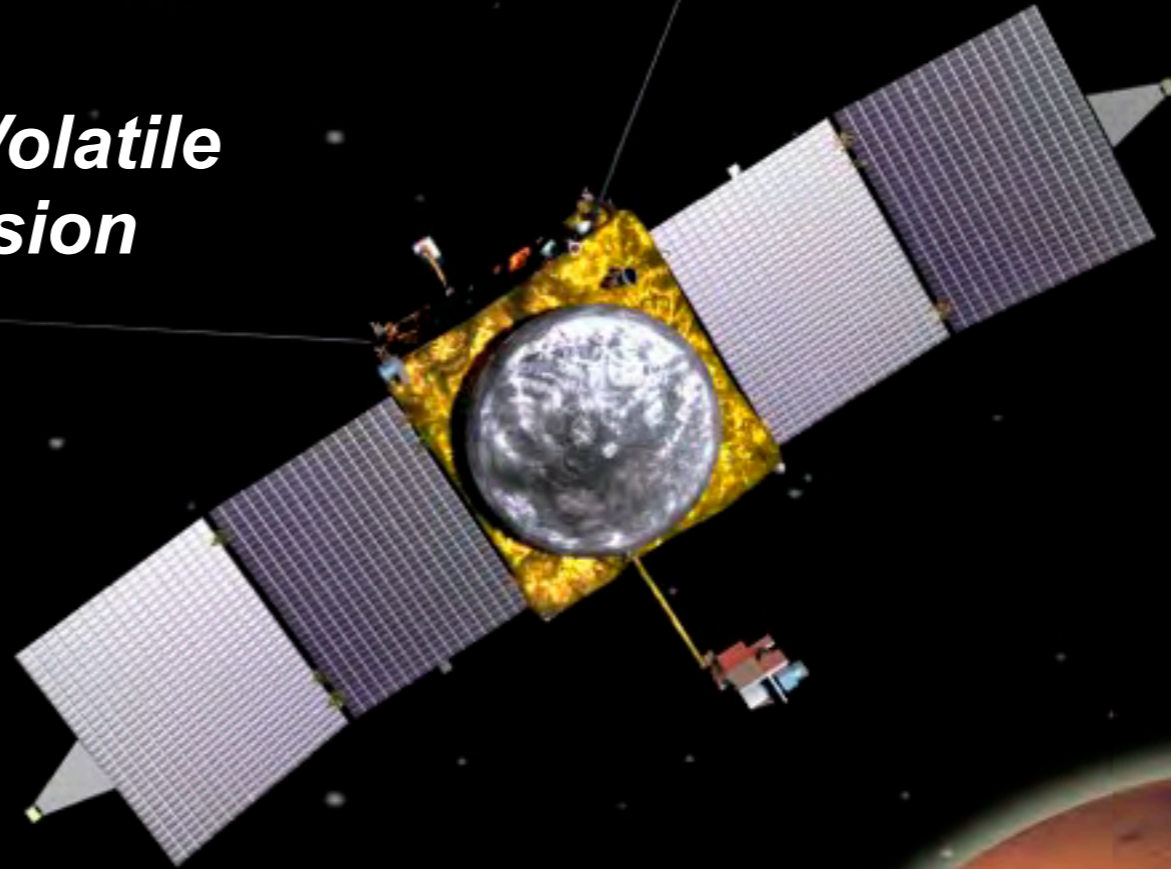


Mars Atmosphere and Volatile Evolution (MAVEN) Mission

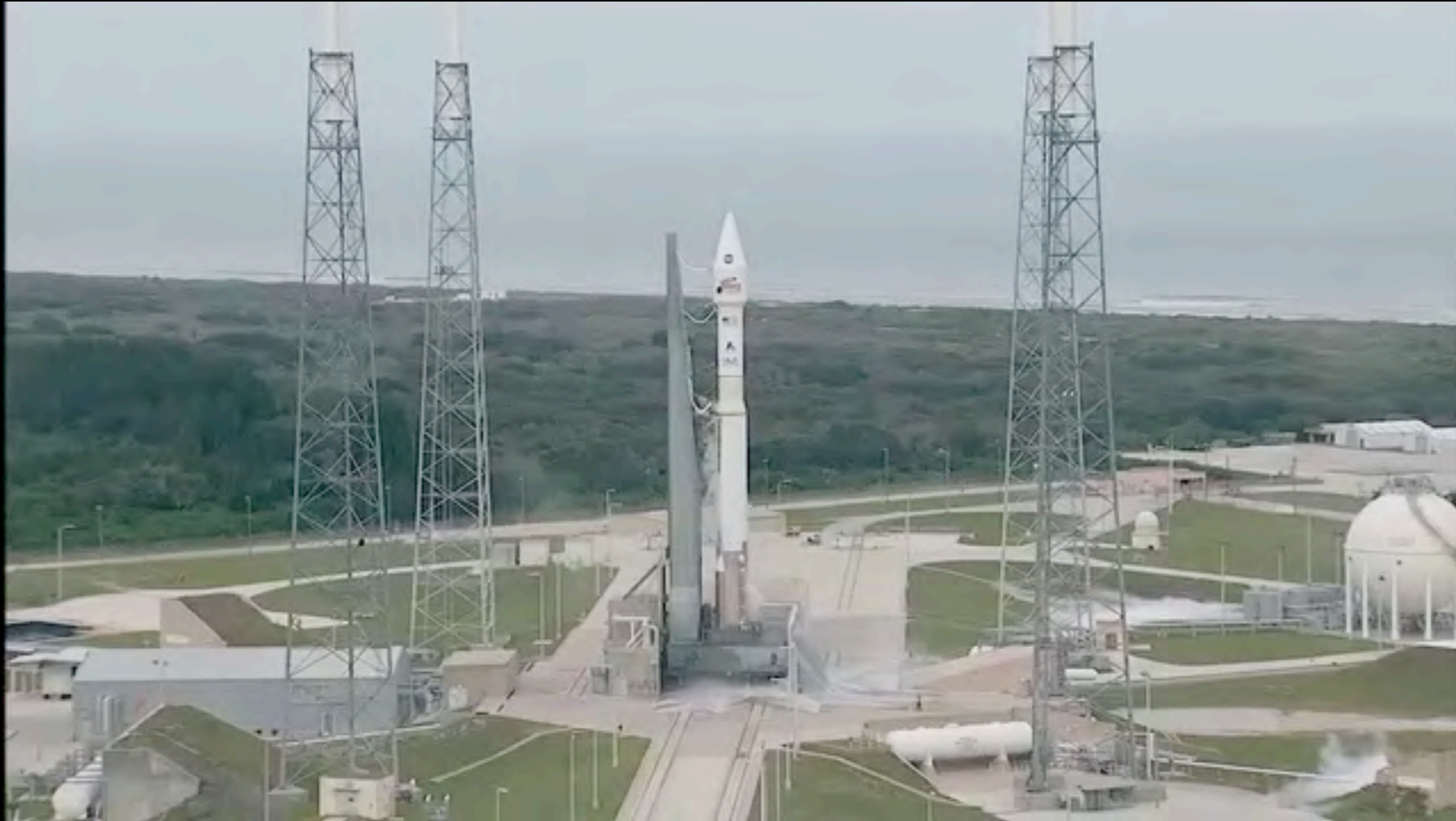
LASP-led Mars Scout Mission
Bruce Jakosky, PI
Launch date: 2013

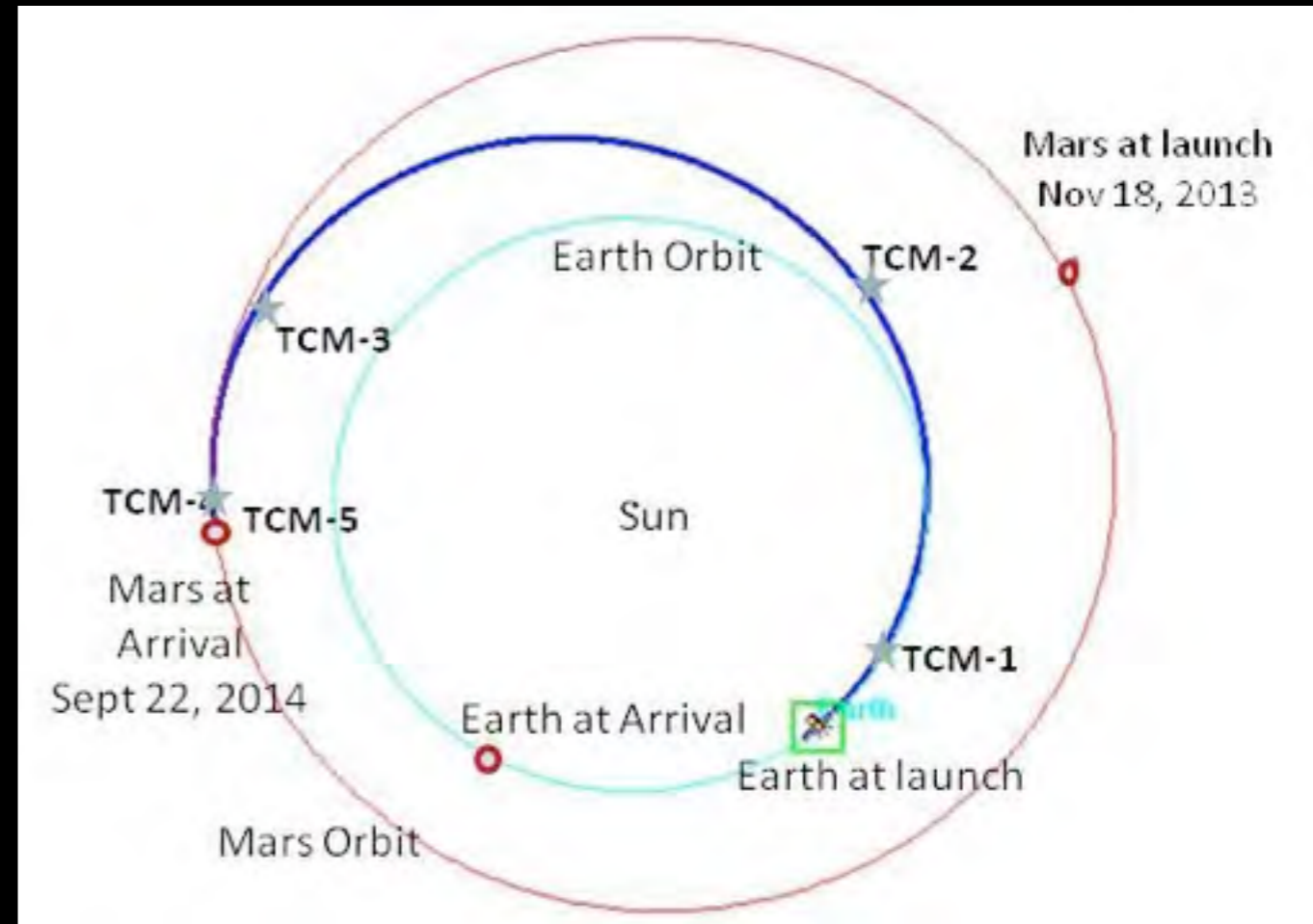
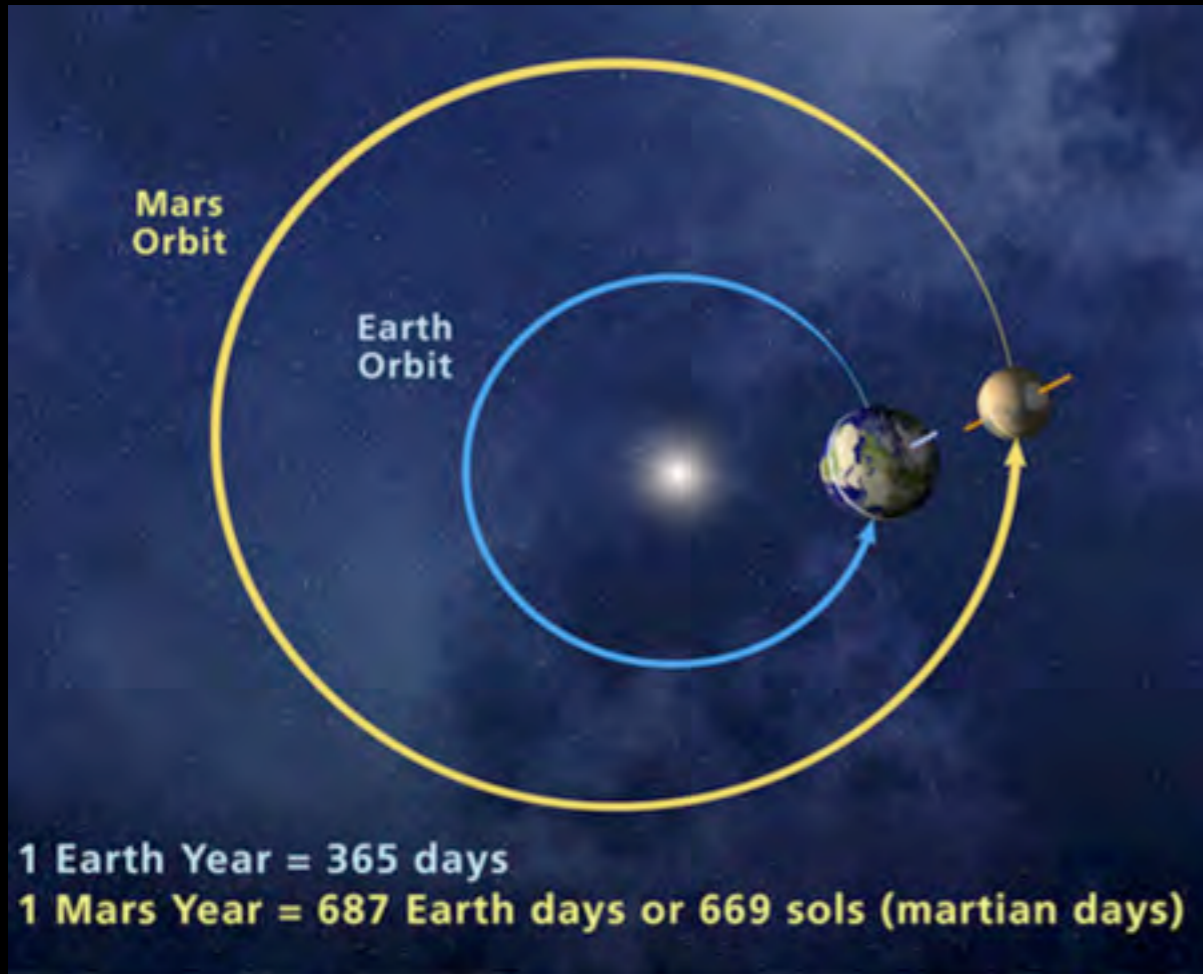


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MAVEN FAMILY & FRIENDS NIGHT JULY 15, 2013

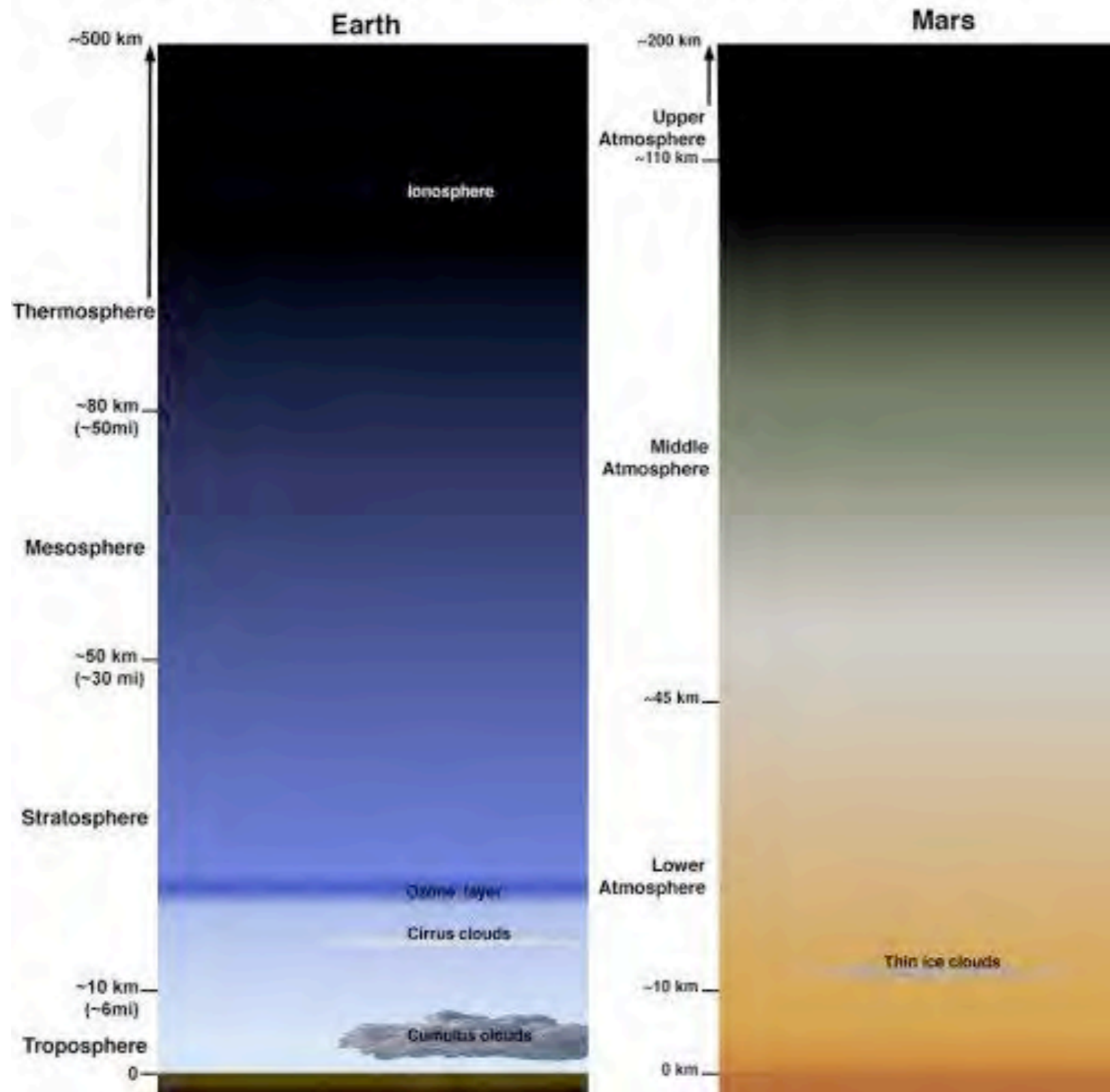




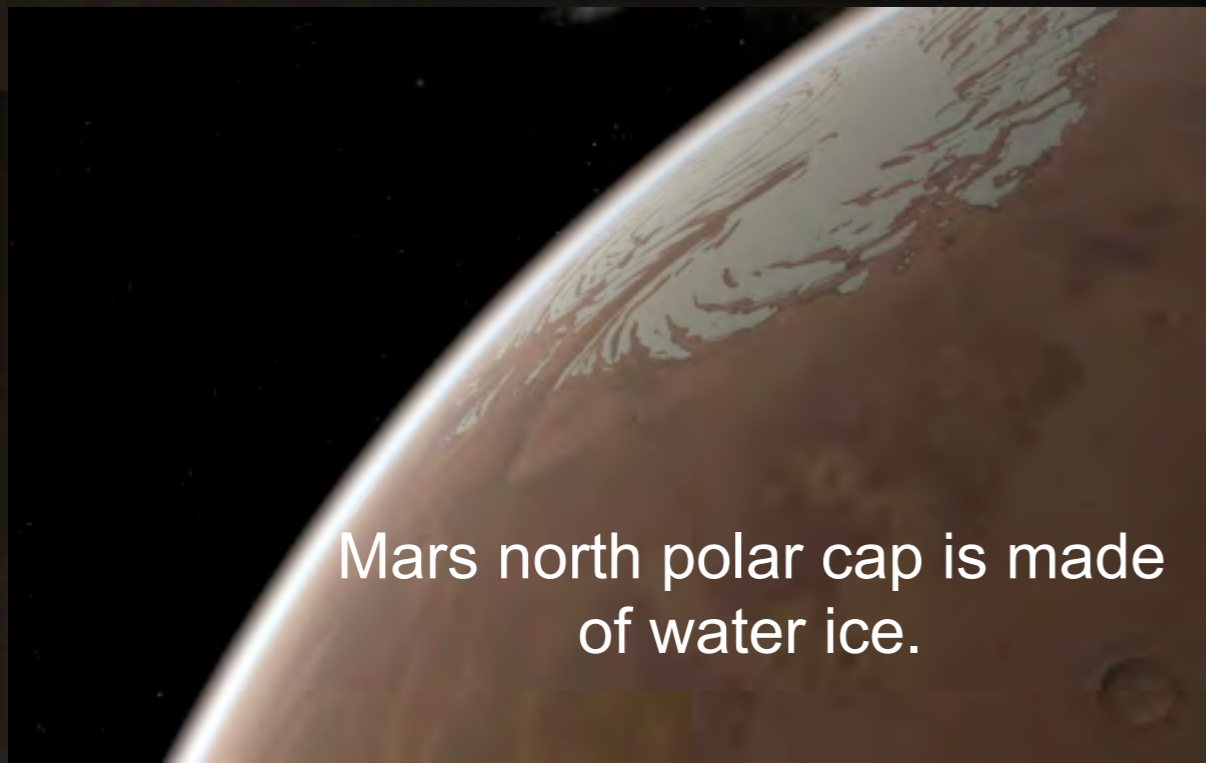
What is Mars Like Today?



A Comparison of the Atmospheres of Earth and Mars



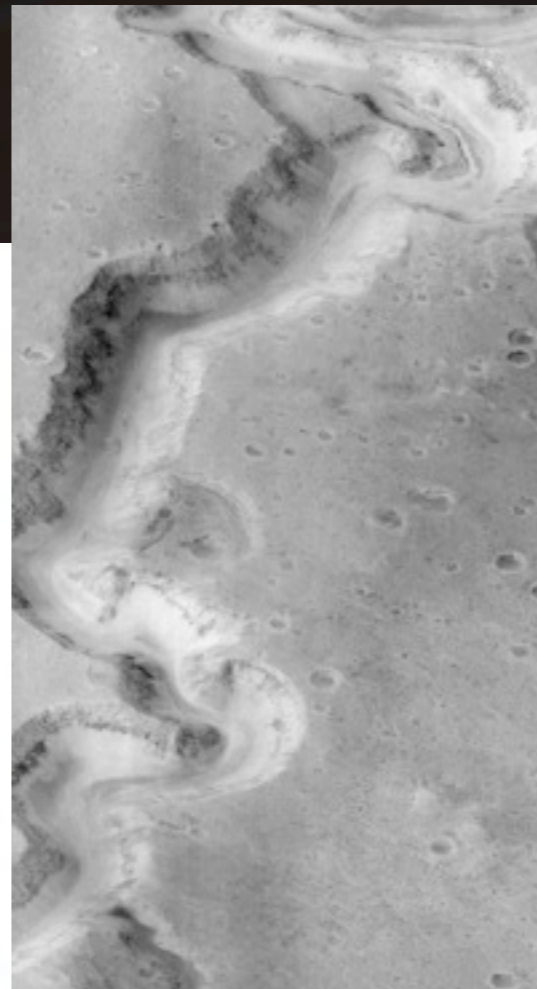
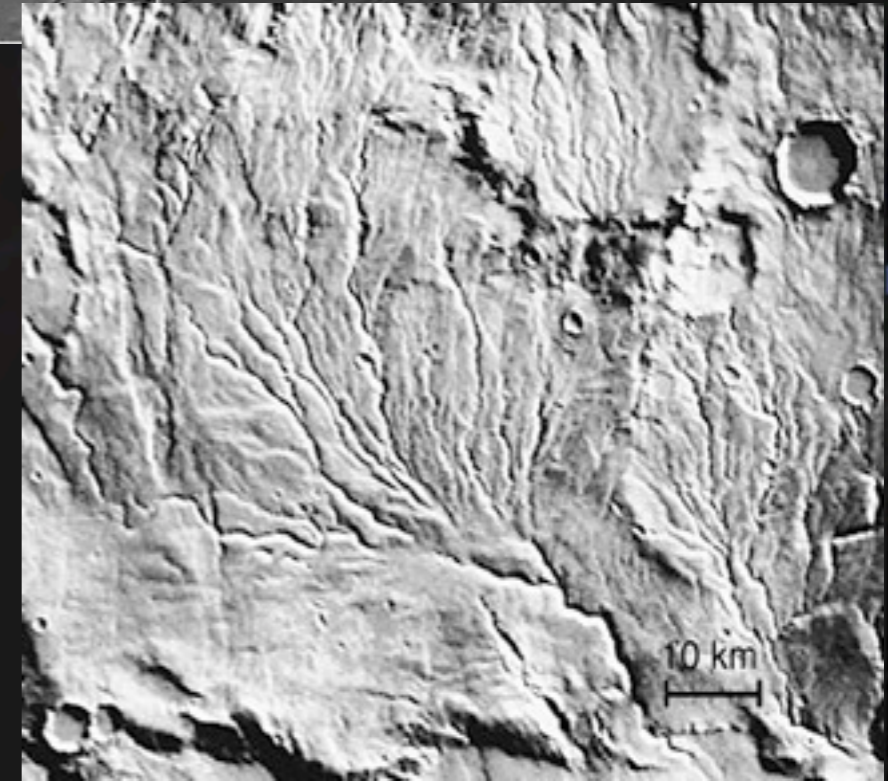
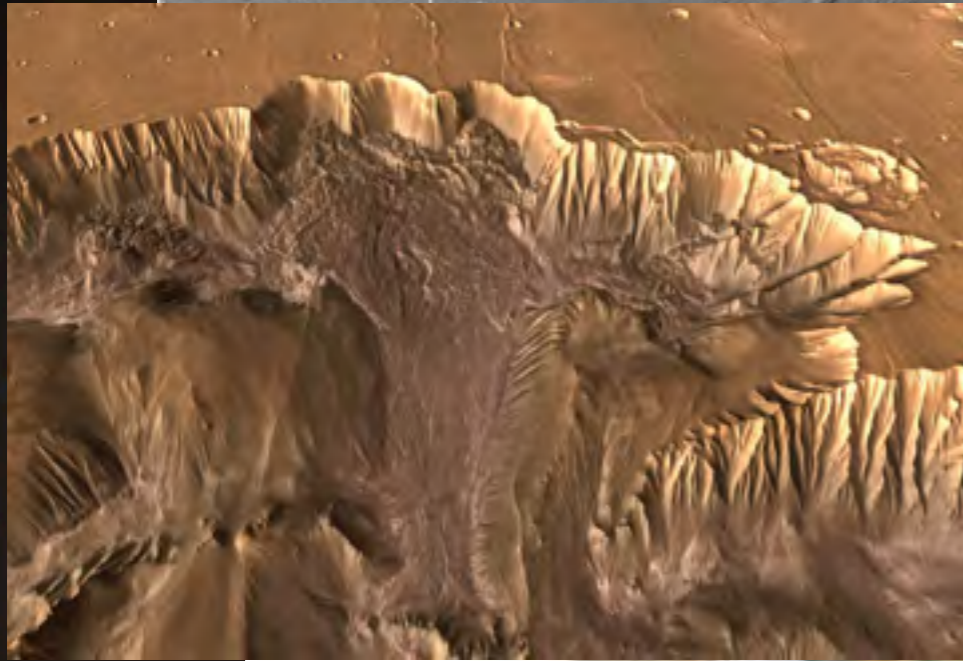
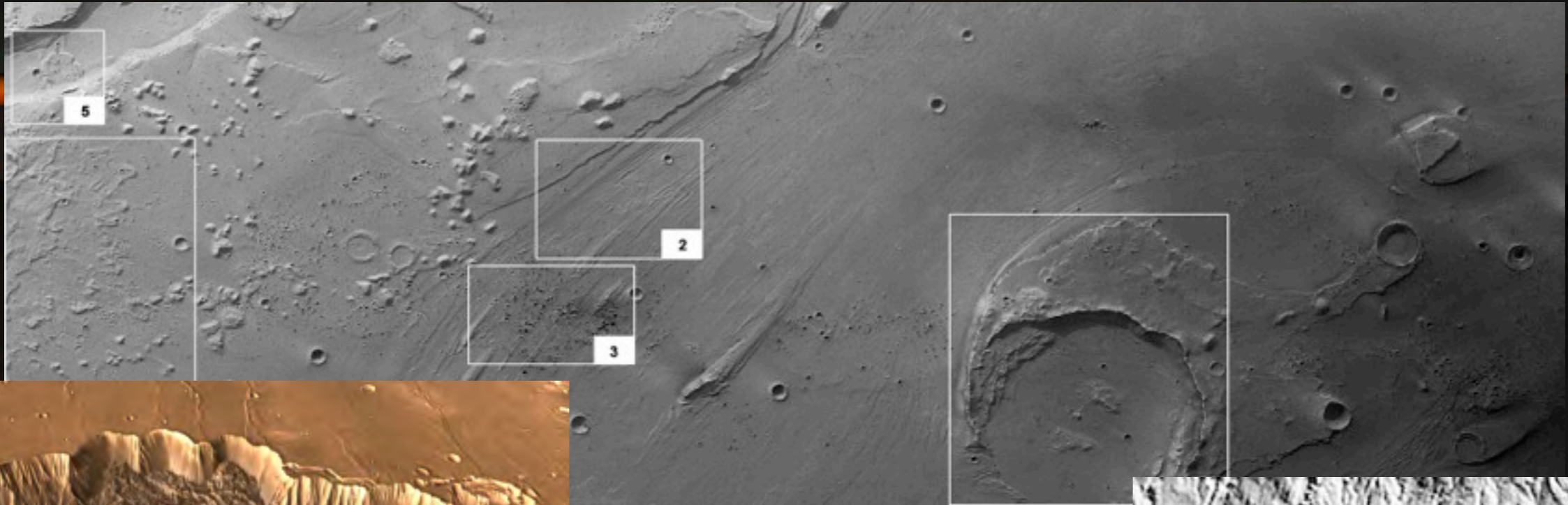
Water Ice is Abundant on Mars Today



The recent *Phoenix* mission uncovered buried water ice at high latitudes.



Did Mars Have a Watery Past? Surface Features Suggest "Yes"



HISTORY OF WATER ON MARS

b.y.a.



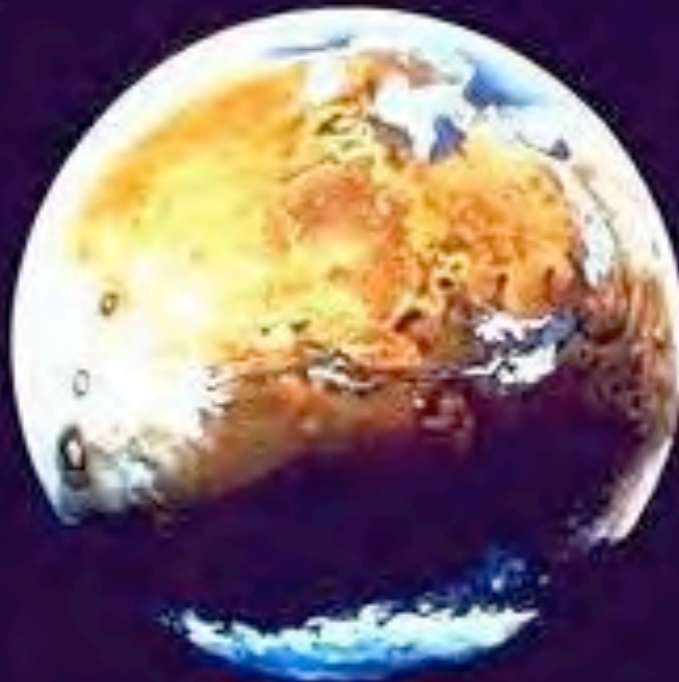
4.0



3.8



3.5



2.0



1.0



Now

If Mars had a thick atmosphere, where it is now?
If Mars had an ocean, where is all the water now?



*Artist's conception
by Mike Carroll*

If Mars had a thick atmosphere, where is it now?
If Mars had an ocean, where is all the water now?

- Frozen at the poles?



*Artist's conception
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If Mars had a thick atmosphere, where is it now?
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*Artist's conception
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If Mars had a thick atmosphere, where is it now?
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- Frozen at the poles?
 - Not enough!
- Locked underground?

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If Mars had a thick atmosphere, where is it now?
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- Locked underground?
 - Not *nearly* enough!

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If Mars had a thick atmosphere, where is it now?
If Mars had an ocean, where is all the water now?

- Frozen at the poles?
 - Not enough!
- Locked underground?
 - Not *nearly* enough!

What other possibilities
are left?

*Artist's conception
by Mike Carroll*

MARS HAS 2 MAJOR PROBLEMS

- Problem 1: It's little!
- Problem 2: It has no global magnetic field.

PROBLEM 1: IT'S LITTLE SO IT HAS LOW GRAVITY

Inside Planet MARS

Often visible as a reddish light in Earth's sky, Mars captured the imaginations of those who dream of space travel. The planet's thin atmosphere is hostile to human life, but Mars has many interesting geological features similar to those on Earth, such as volcanoes and canyons.

THIN ATMOSPHERE
 95.32% carbon dioxide, 2.7% nitrogen, 1.6% argon, 0.13% oxygen, 0.08% carbon monoxide

GRAVITY
 0.38 OF EARTH

SURFACE CONDITIONS
 AIR PRESSURE: 0.7% of Earth
 AVERAGE TEMPERATURE: -67°F (-55°C)

LIQUID IRON-SULPHUR CORE
MANTLE
CRUST
POSSIBLE SOLID INNER CORE

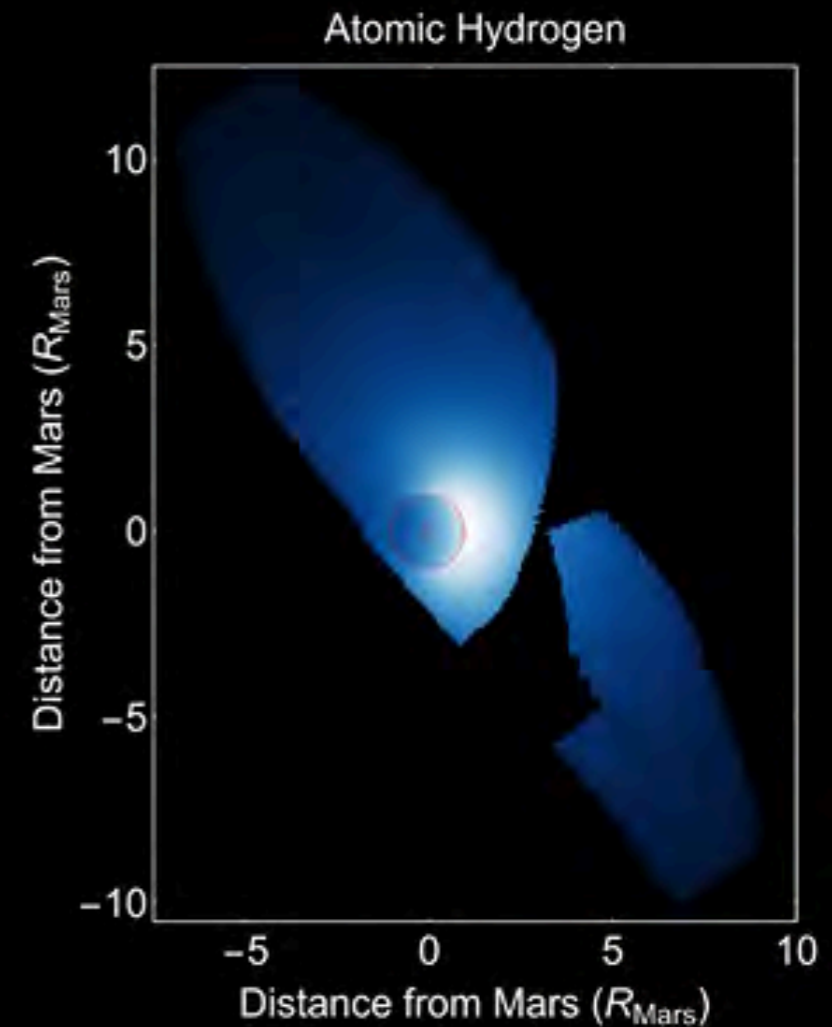
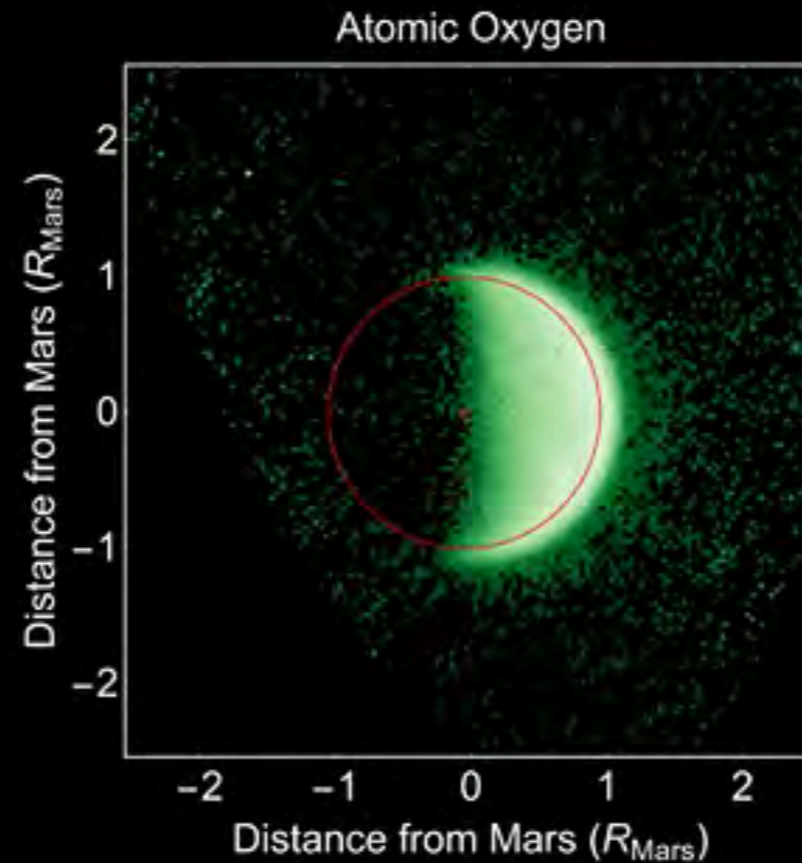
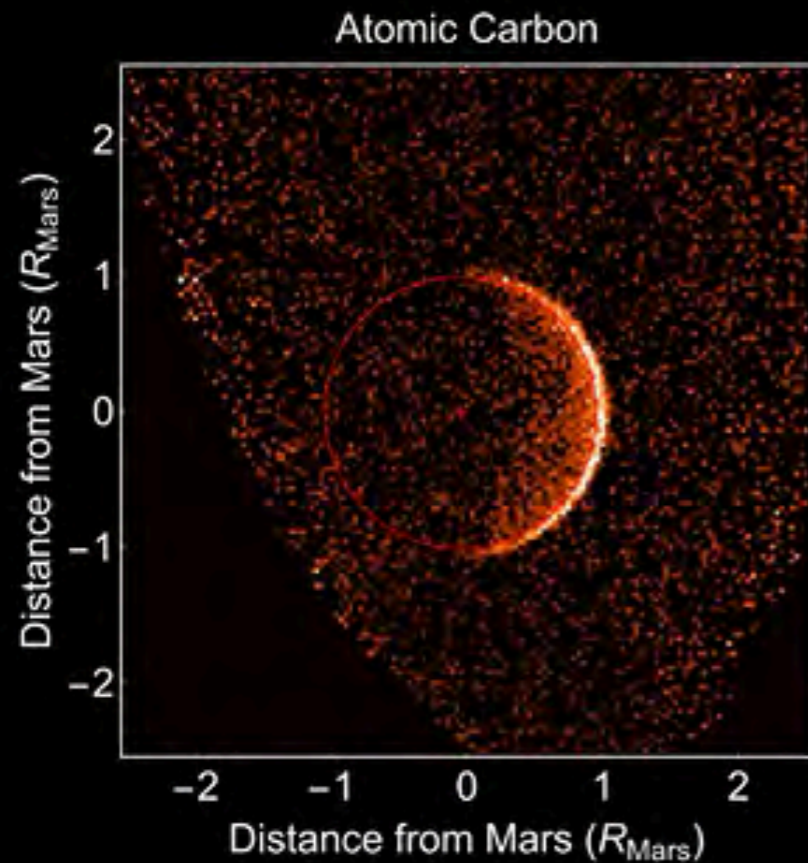
EARTH 10 ft dunk
MARS 26.3 ft dunk

Martian sunset photographed by the Spirit rover at Gusev crater in 2005

Mars, 4,222 mi (6,794 km) in diameter, is slightly over half the size of Earth

SOURCE: ARGONNE NATIONAL LABORATORY, NASA, HSTSCI
 KARL TATE, SPACE.com

Atmospheric loss BECAUSE of problem 1



Three views of an escaping atmosphere

Problem 1 leads to Problem 2

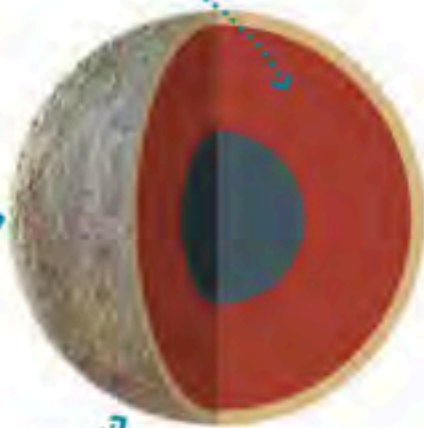
The Role of Planetary Size

Small Terrestrial Planets

Interior cools rapidly...

...so that tectonic and volcanic activity cease after a billion years or so. Many ancient craters therefore remain.

Lack of volcanism means little outgassing, and low gravity allows gas to escape more easily; no atmosphere means no erosion.



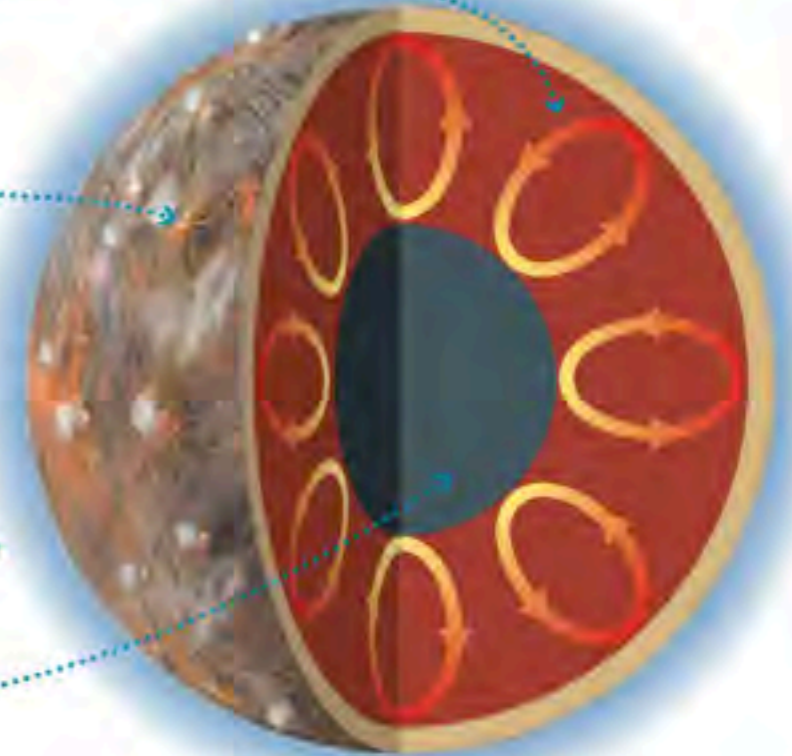
Large Terrestrial Planets

Warm interior causes mantle convection...

...leading to ongoing tectonic and volcanic activity; most ancient craters have been erased.

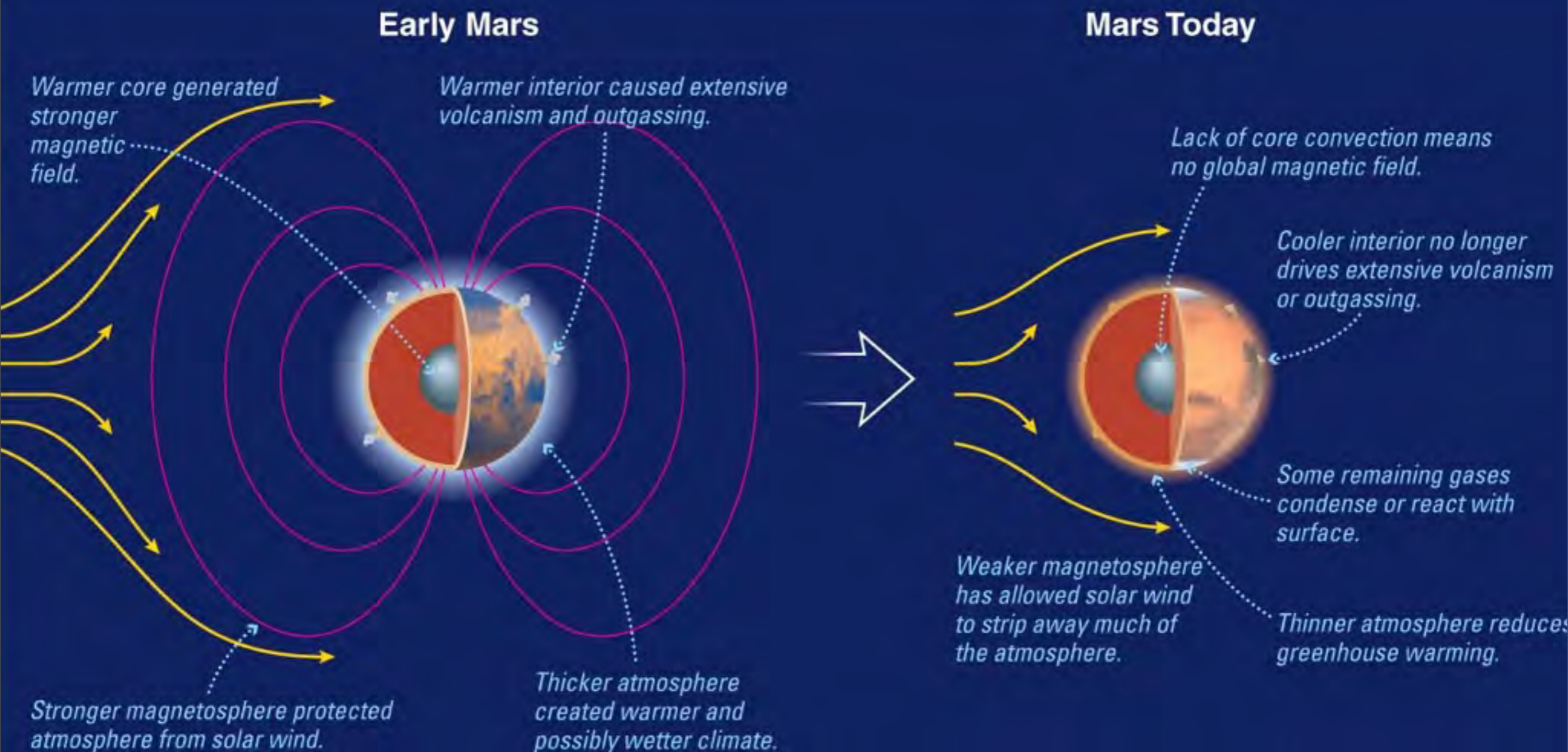
Outgassing produces an atmosphere and strong gravity holds it, so that erosion is possible.

Core may be molten, producing a magnetic field if rotation is fast enough.

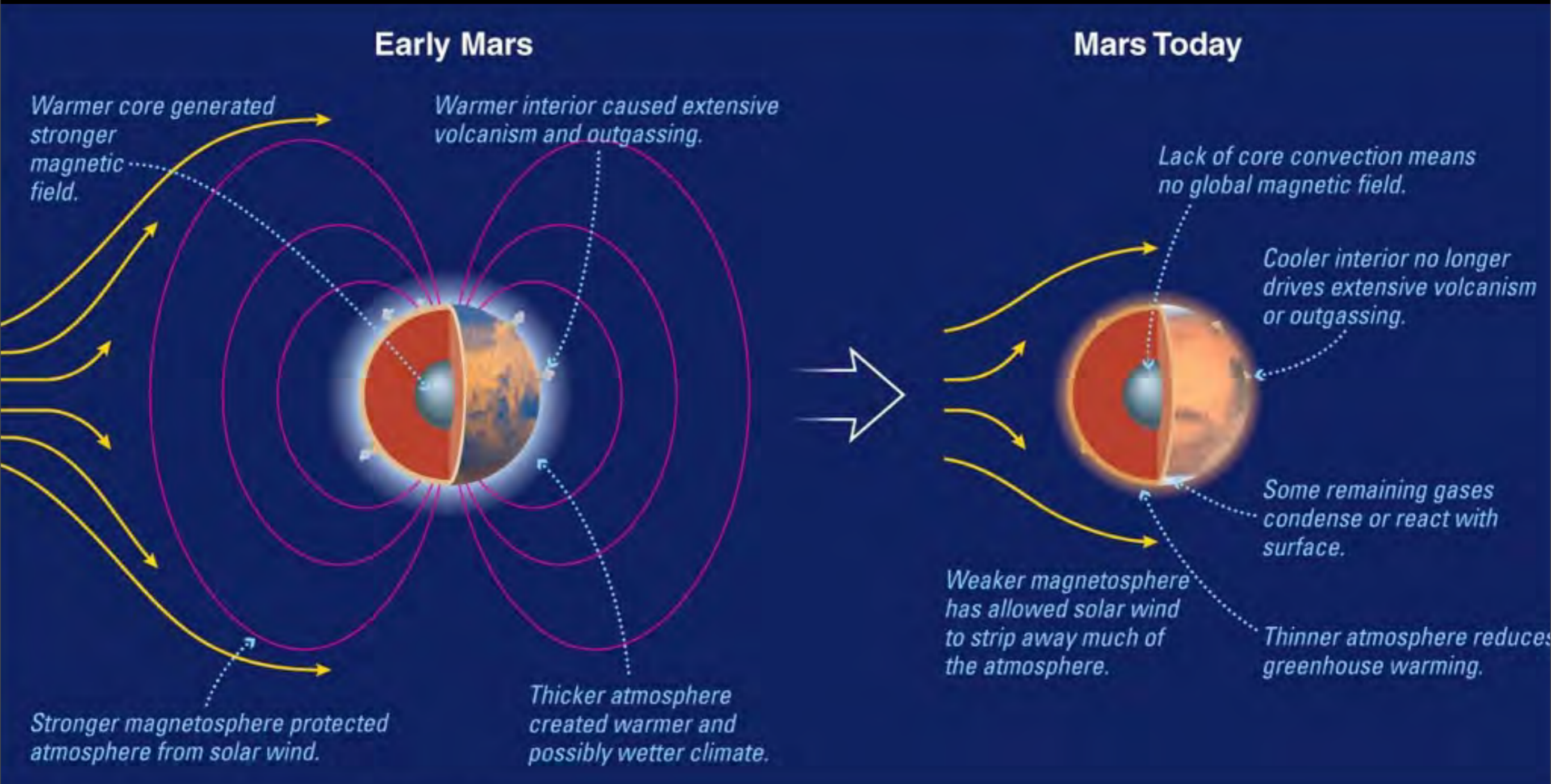


- Smaller worlds cool off faster and “harden” earlier
- Larger worlds stay warmer inside, leading to more volcanism and tectonics
- Larger worlds CAN have more erosion because they can create and hold an atmosphere

Problem 2: Mars has no global magnetic field

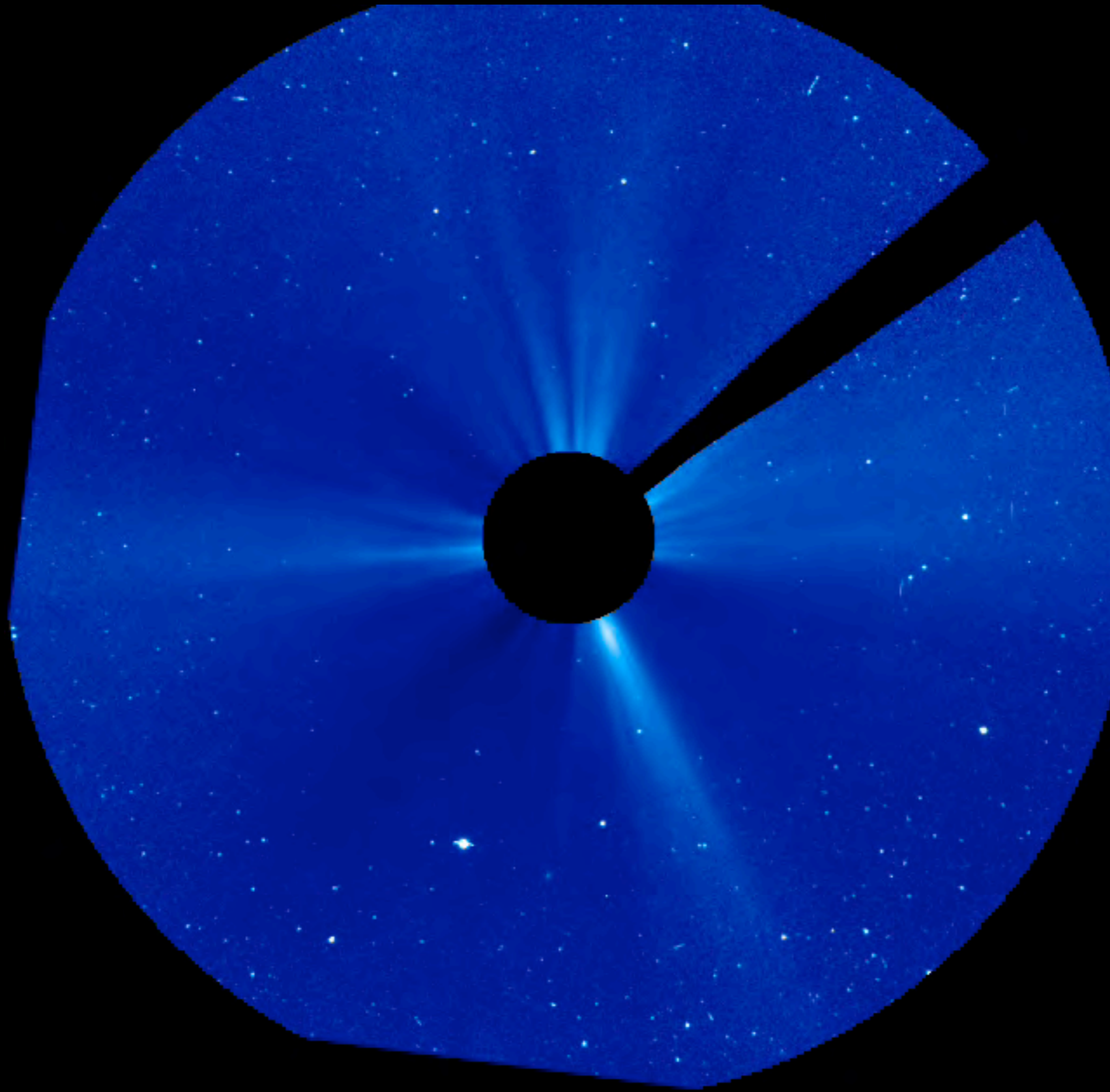


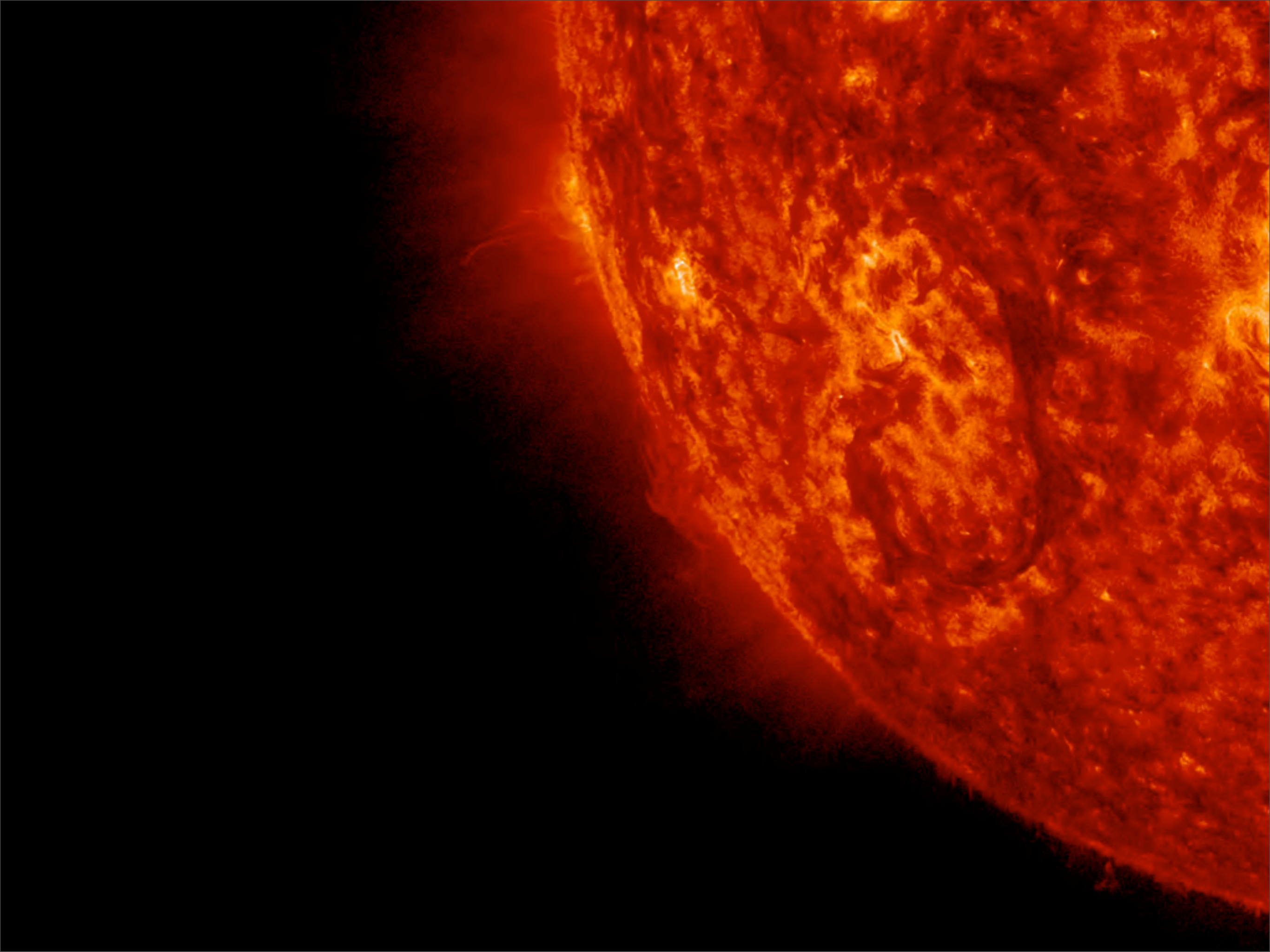
Problem 2: Mars has no global magnetic field



The End of the World – for Martians?

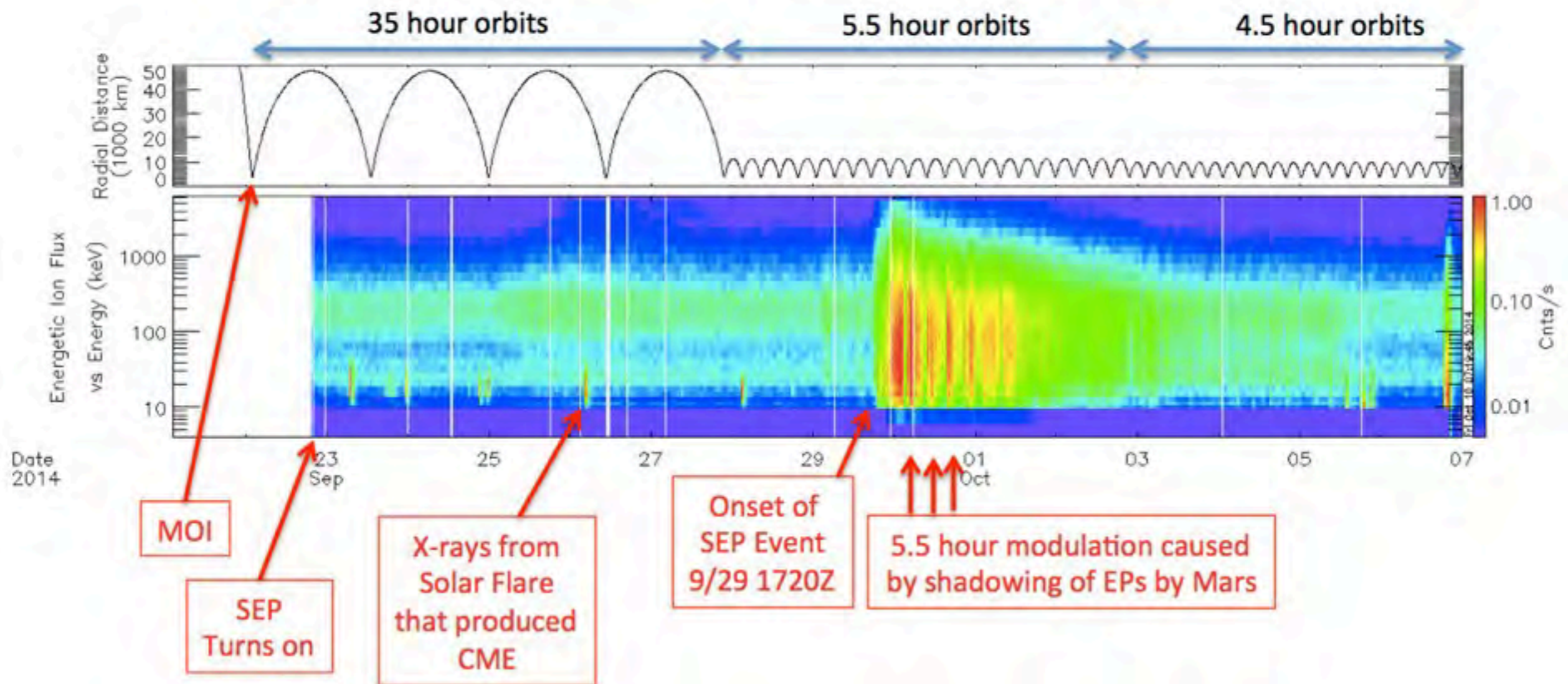
Solar wind blasts planets





Solar energetic particles detected by MAVEN instruments

First SEP Event Observed at Mars by MAVEN



Problem 2: Mars has no global magnetic field

