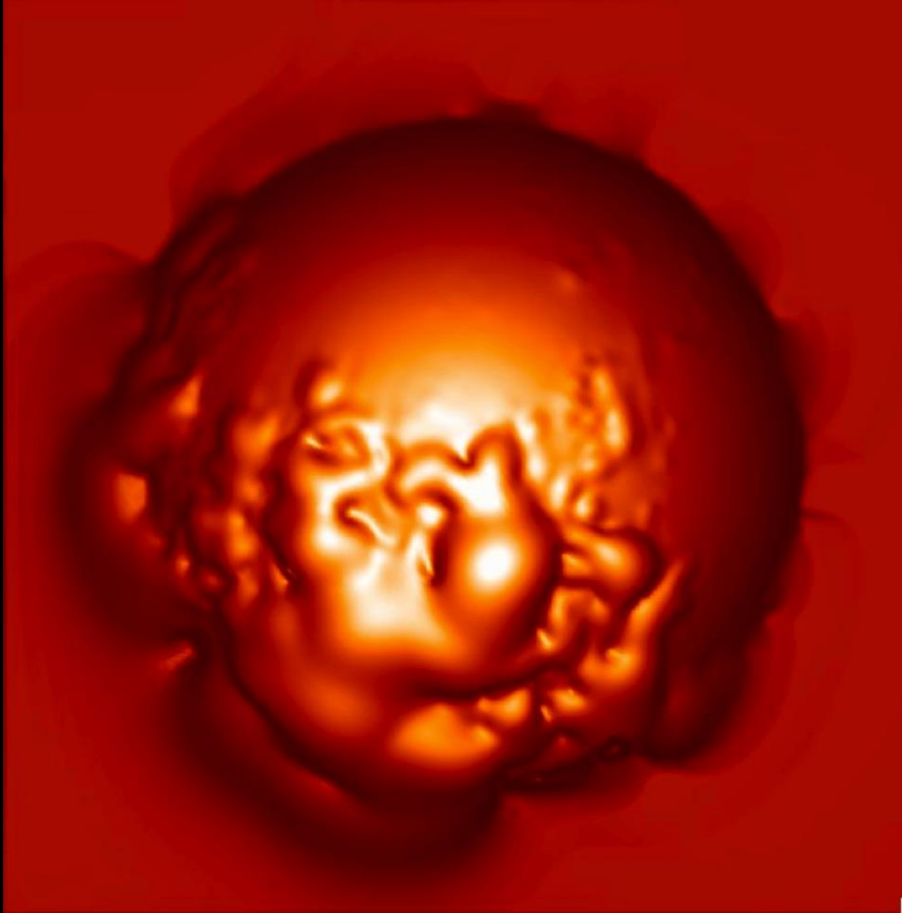


Planetary Magnetism

How crucial is a planet's magnetic field?



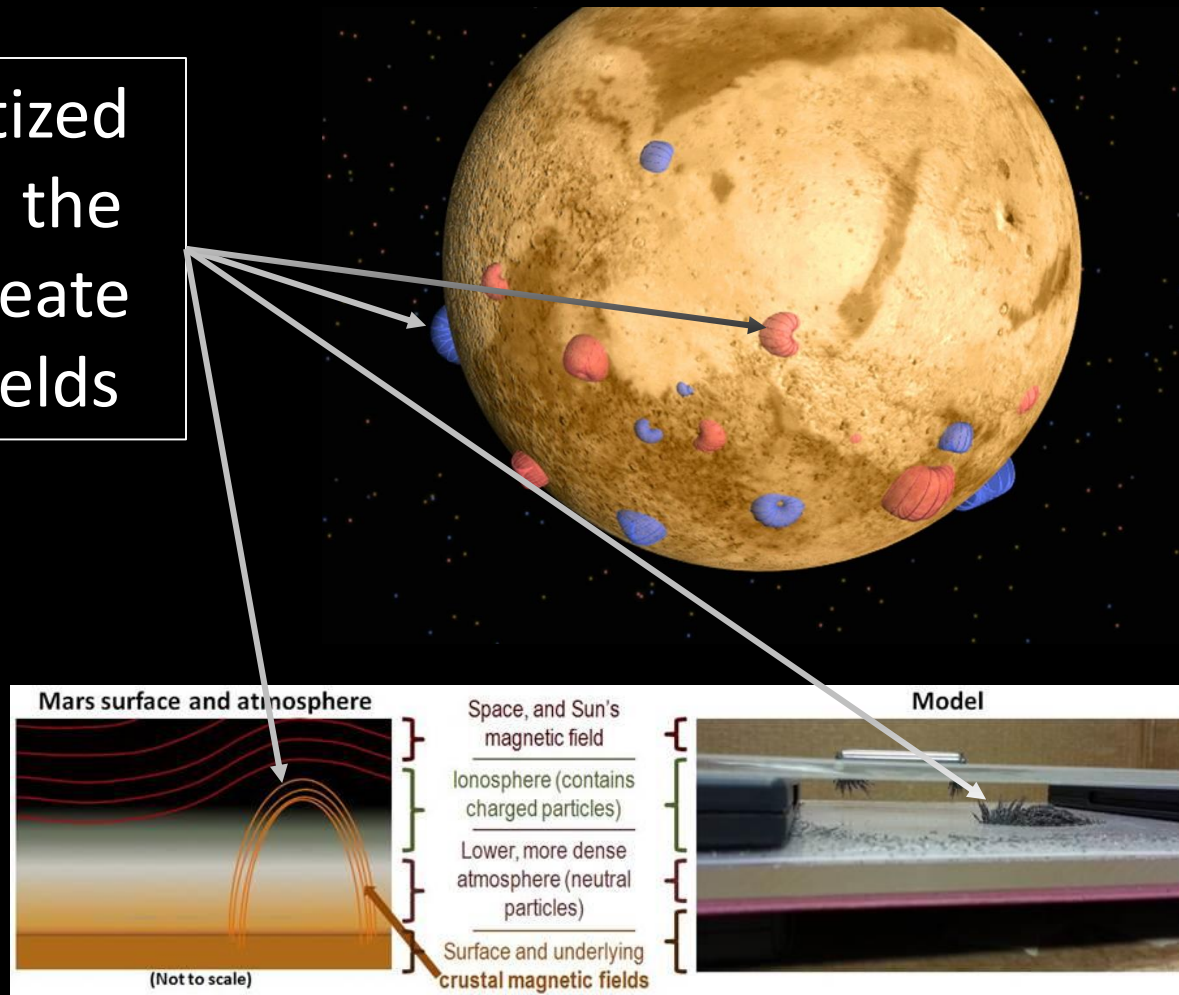
The Solar Wind

The solar wind is a stream of mostly charged particles that emanate from the Sun and blow throughout the Solar System. The Sun's Magnetic field flows with these particles.



Mars's crust has small pockets with magnetic fields. The atmosphere covered by these pockets of magnetic fields are protected from the Sun's harmful effects. The rest is not.

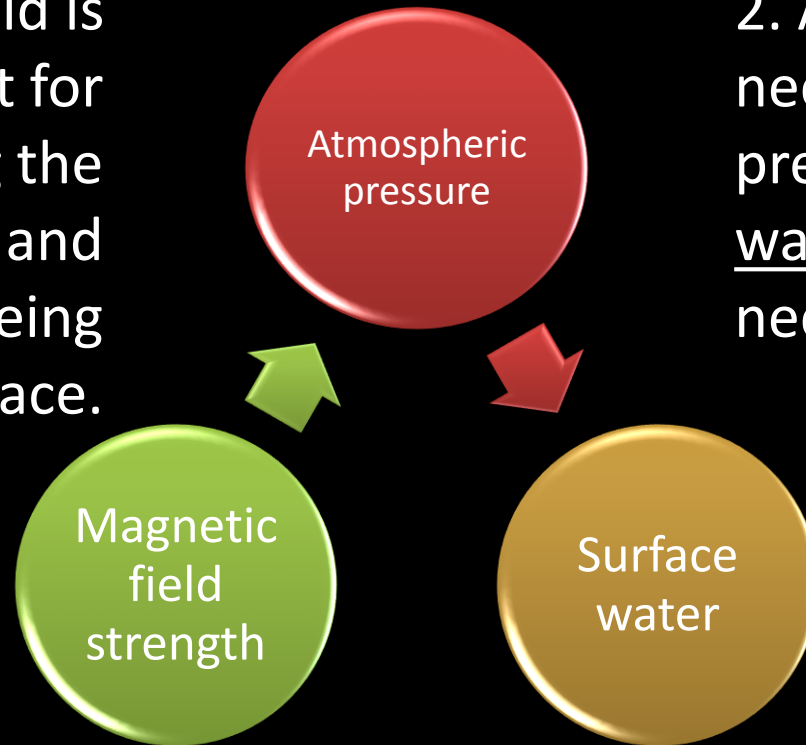
Magnetized rocks in the crust create these fields



Why do we care about the magnetic field?

1. Magnetic field is important for protecting the atmosphere and keeping it from being lost to space.

2. Atmosphere is necessary for the presence of surface water which is necessary for LIFE.



But...Mars has no surface water anymore...

Scientists have evidence that there once was water on Mars...



Curiosity Rover #Selfie on surface of the Mars Planet

The features seen on Mars' surface suggests that billions of years ago, water flowed on the surface of Mars.

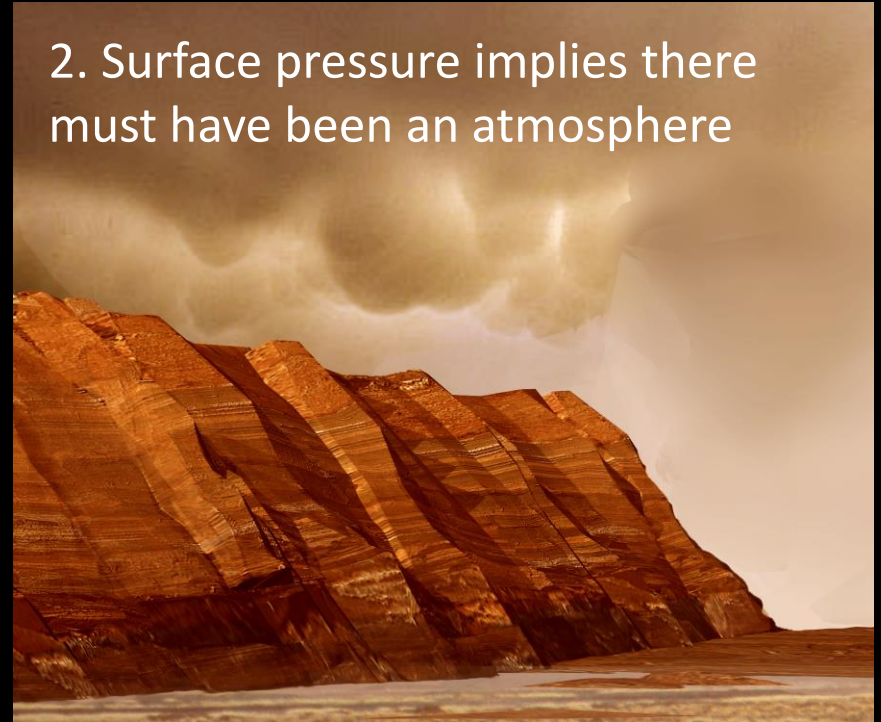
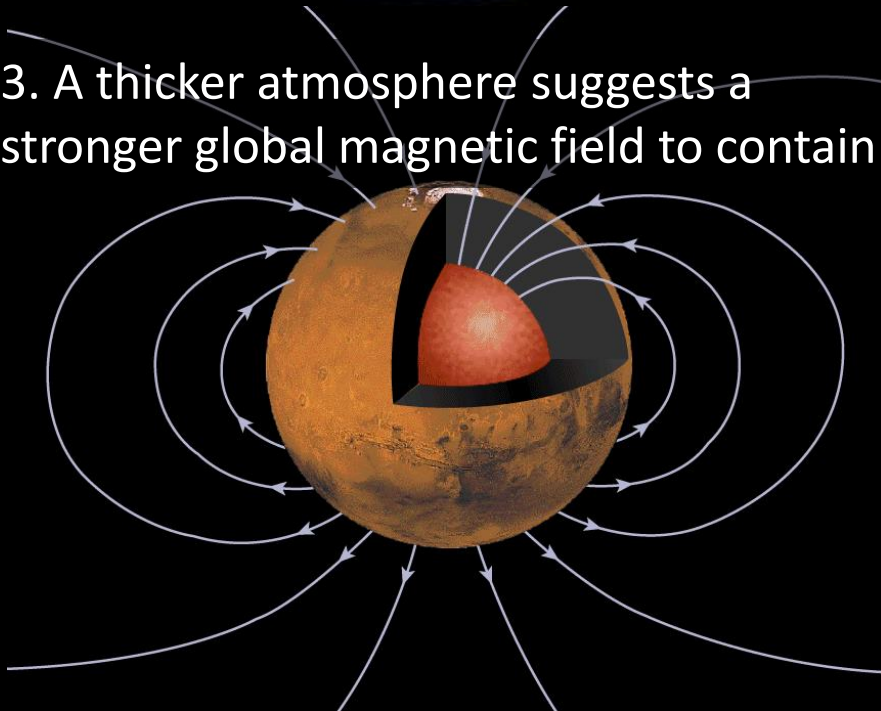
This has since been confirmed by NASA missions such as Mars Global Surveyor, Phoenix, and most recently the Curiosity Rover.

1. Water on ancient Mars means there must have been higher surface pressure

A billion years ago, Mars' surface had water

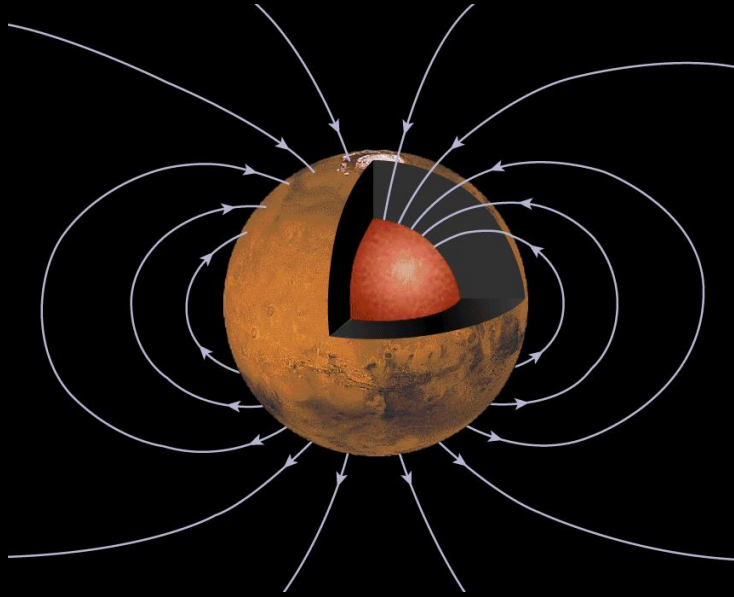
2. Surface pressure implies there must have been an atmosphere

3. A thicker atmosphere suggests a stronger global magnetic field to contain it!

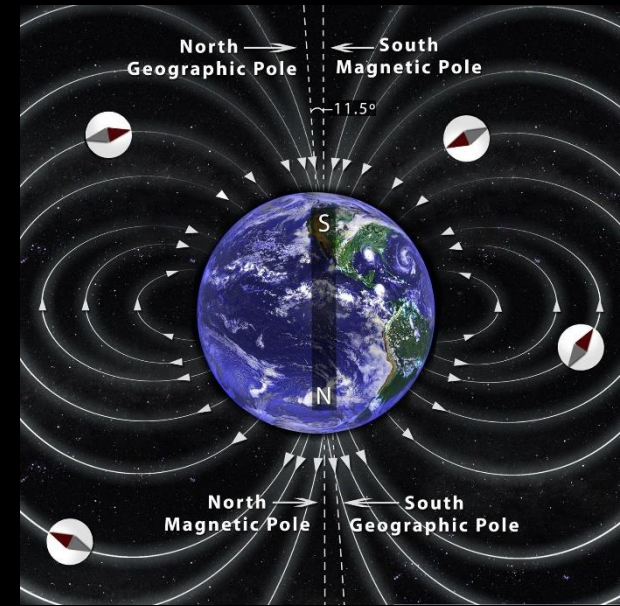


Ancient Mars looks a lot like today's Earth

Ancient Mars



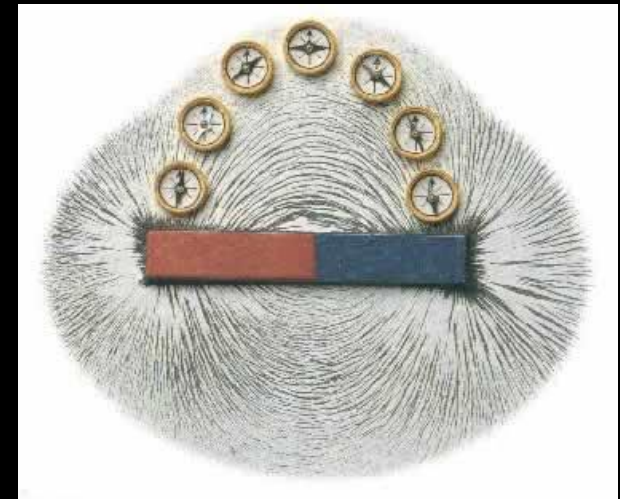
Modern Earth



Today, Earth has a large *global* magnetic field (like a bar magnet), has surface water, supports life, and has a thick atmosphere.

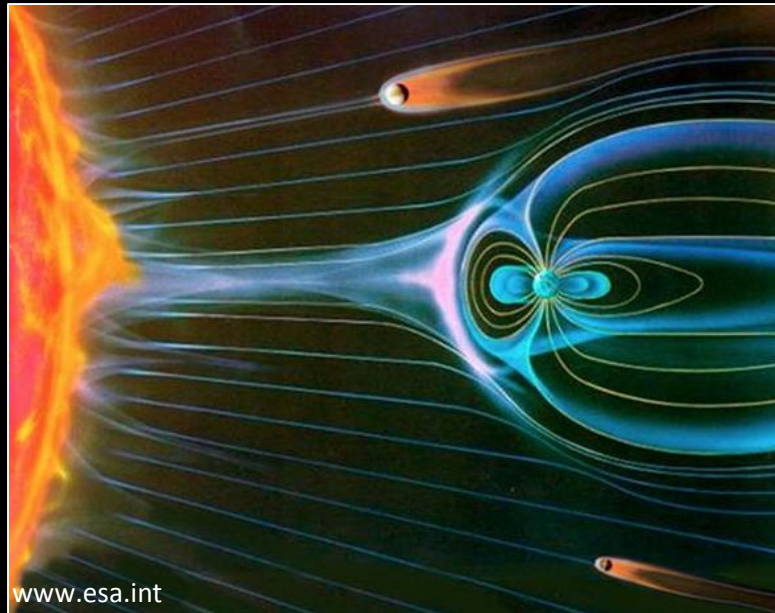
Does that mean Mars' once had these things too?

Will Earth eventually evolve to be like Mars today?

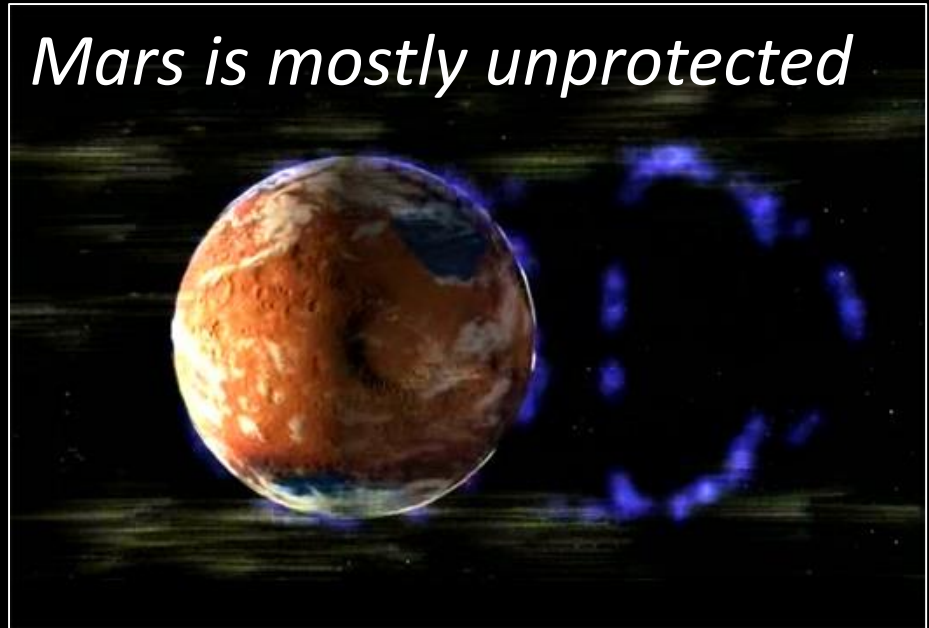


A global magnetic field helps to protect a planet's atmosphere from the harmful effects of the Sun's magnetic field and solar wind.

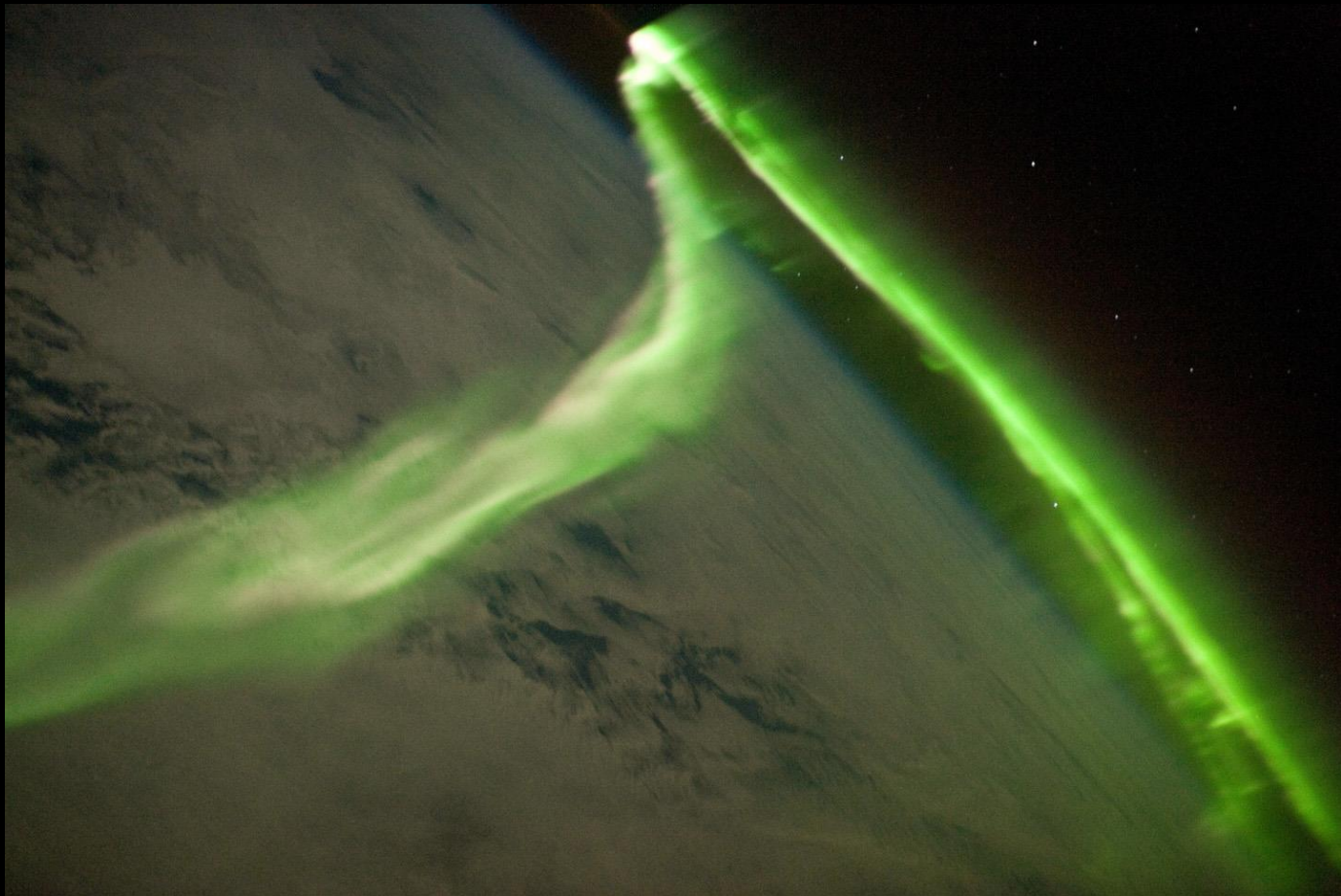
Earth is protected



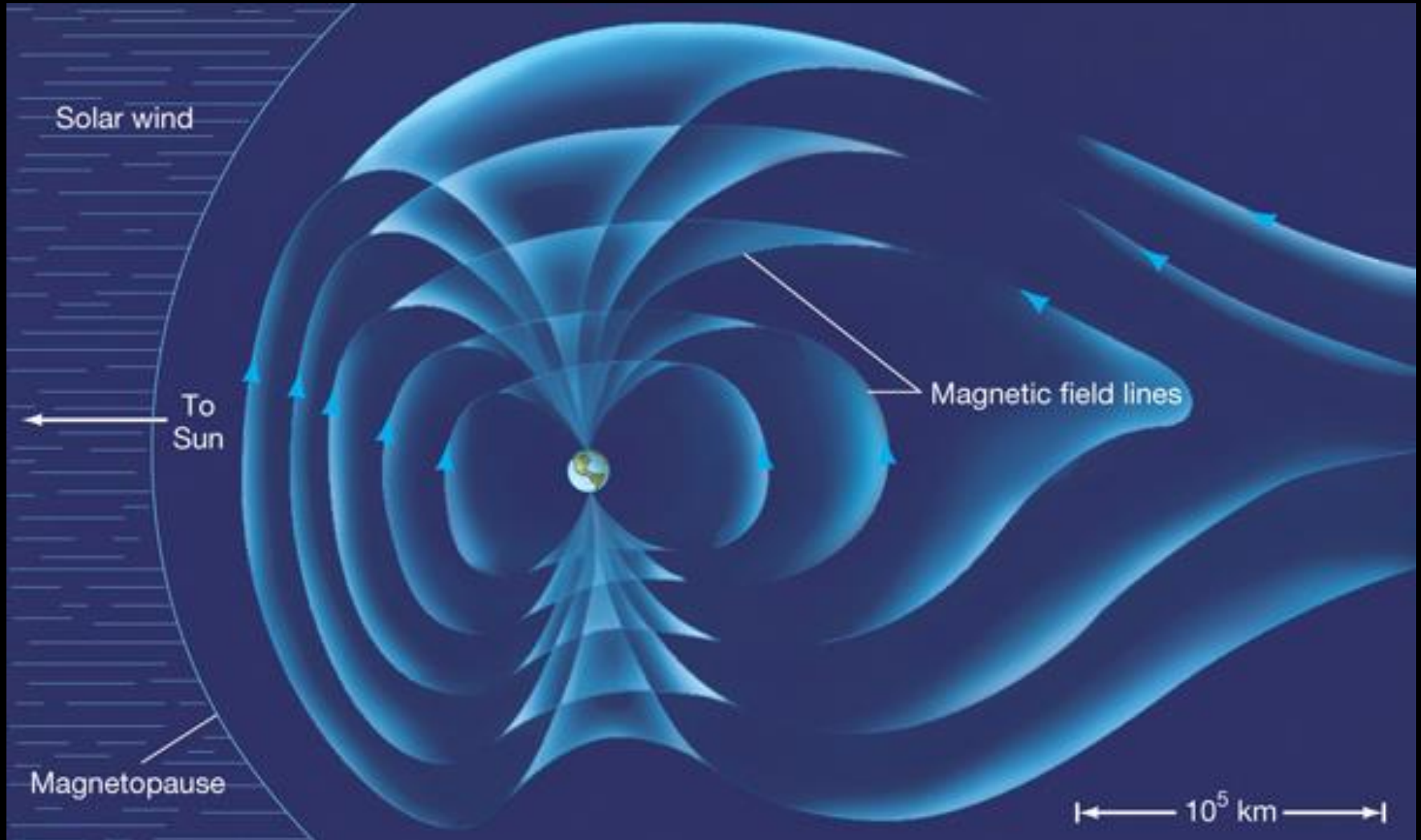
Mars is mostly unprotected



The Earth's magnetic field is vital for life on Earth. It also is also an integral part of the beautiful light show called the aurora.

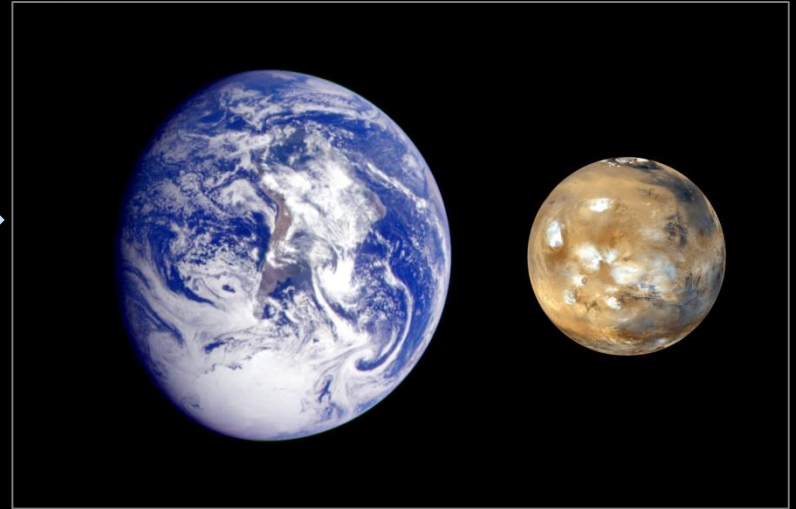


All of Earth is protected by a very strong and global magnetic field



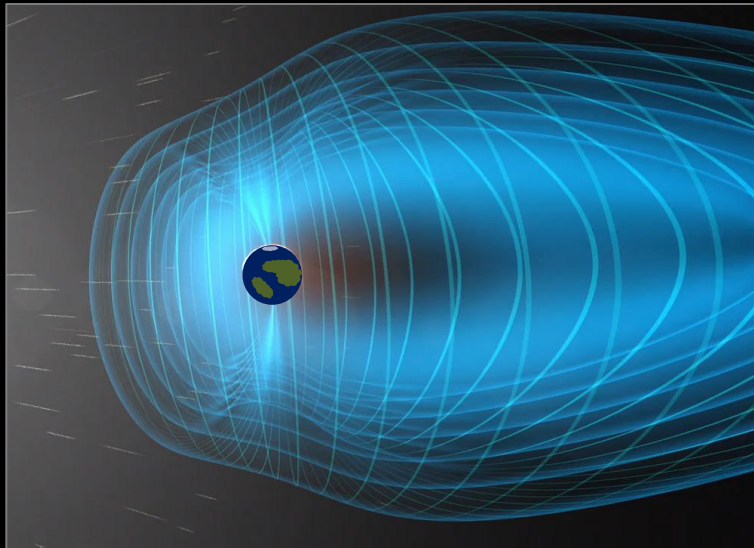
**Today, Mars has no liquid water on its surface
and no global magnetic field ☹**

**Relative sizes of
Earth and Mars** →

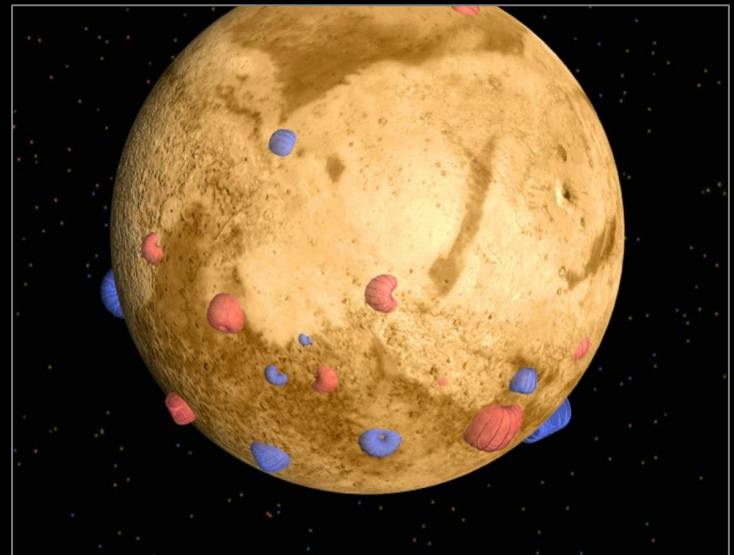


**Shape of their
magnetic fields**

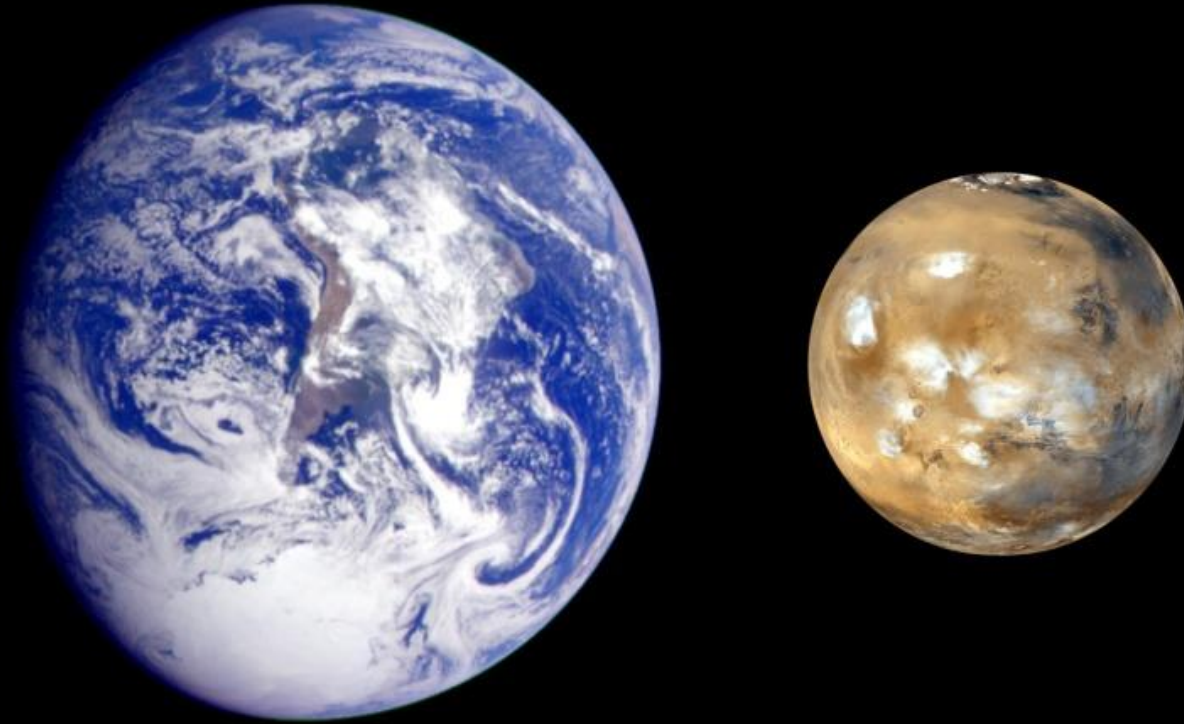
Earth



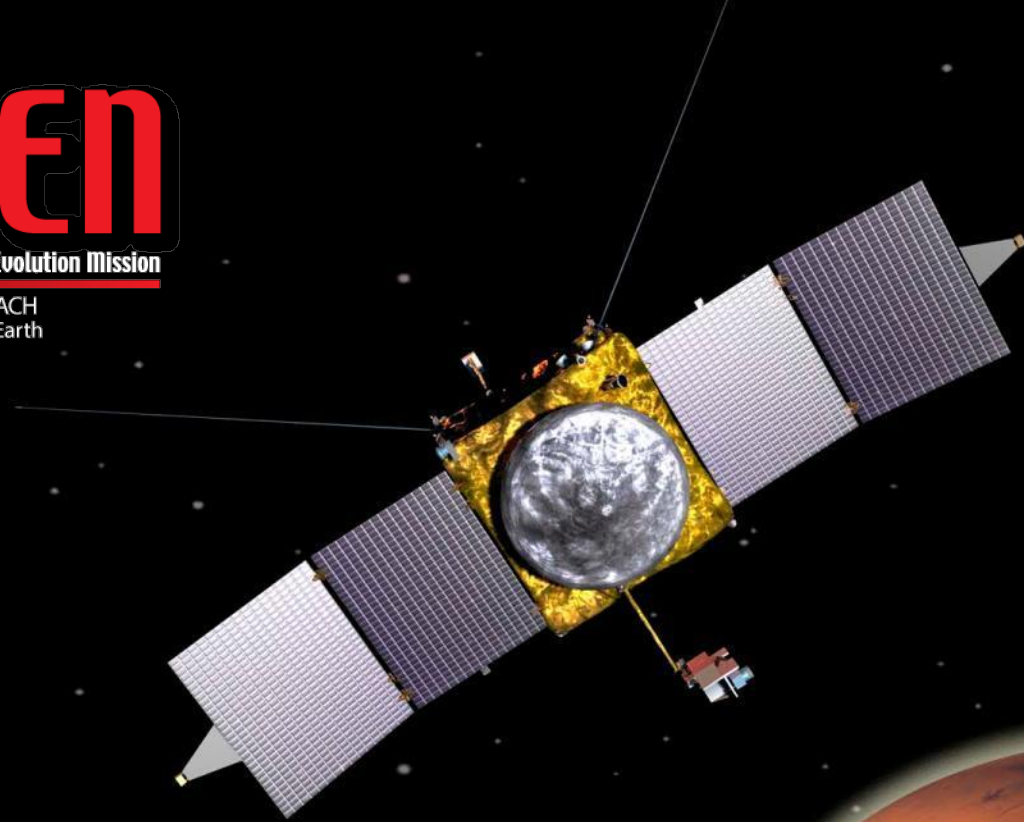
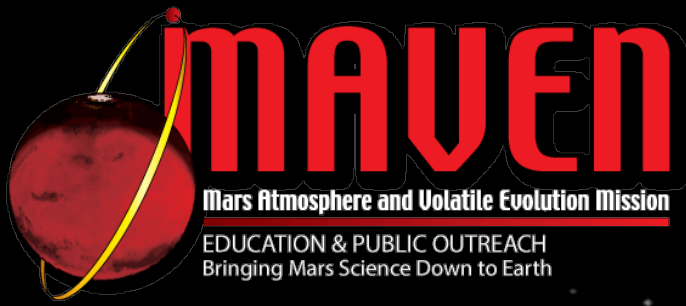
Mars



Today we know that the atmosphere of Mars is less than 1% the thickness of Earth's atmosphere....



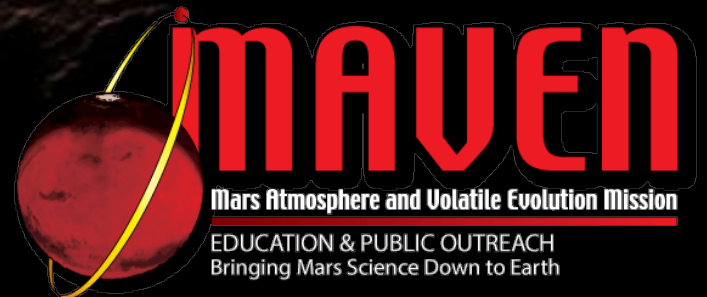
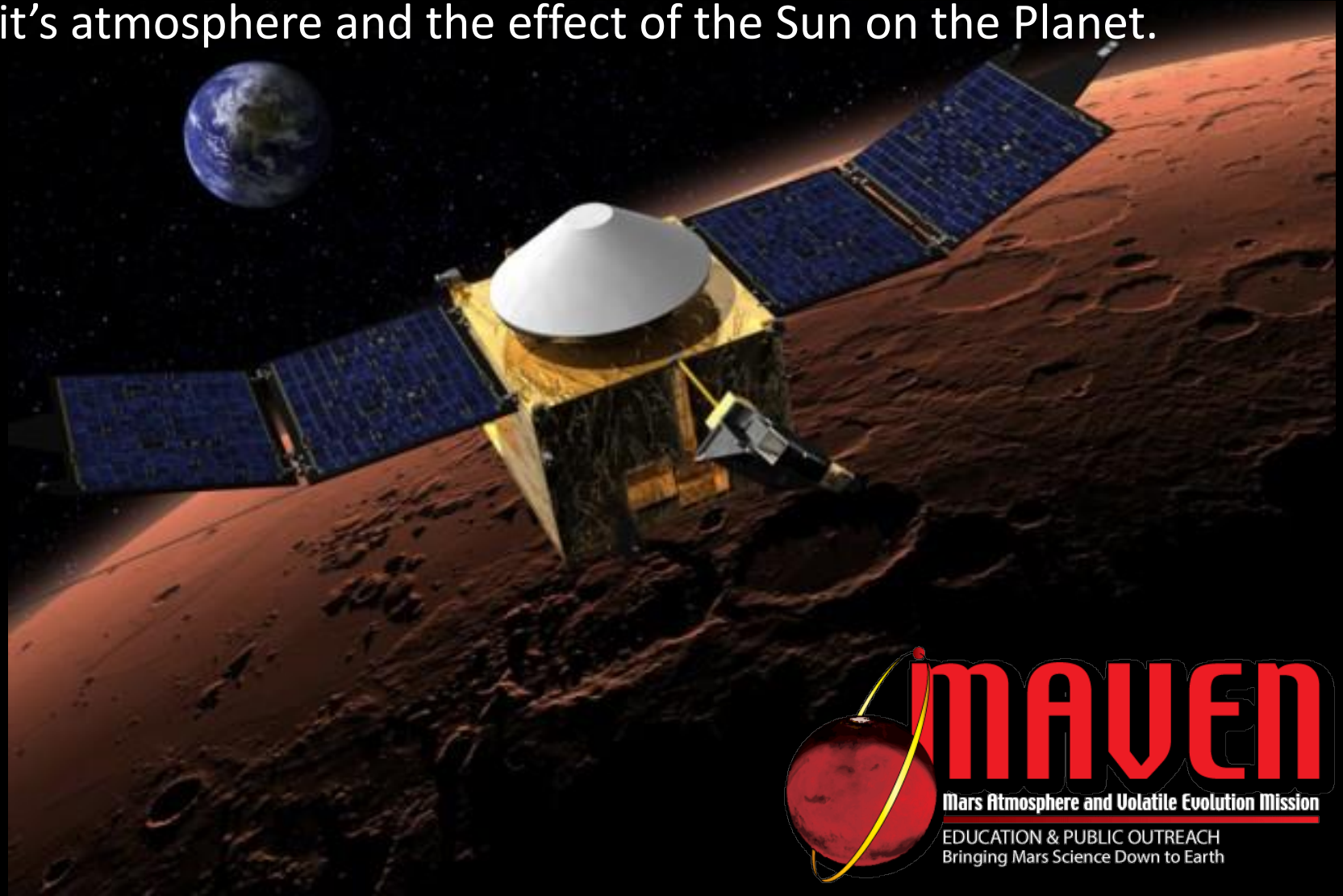
...So what happened on Mars?



*The 2013 Mars Atmosphere
and Volatile Evolution
(MAVEN) Mission will
investigate*

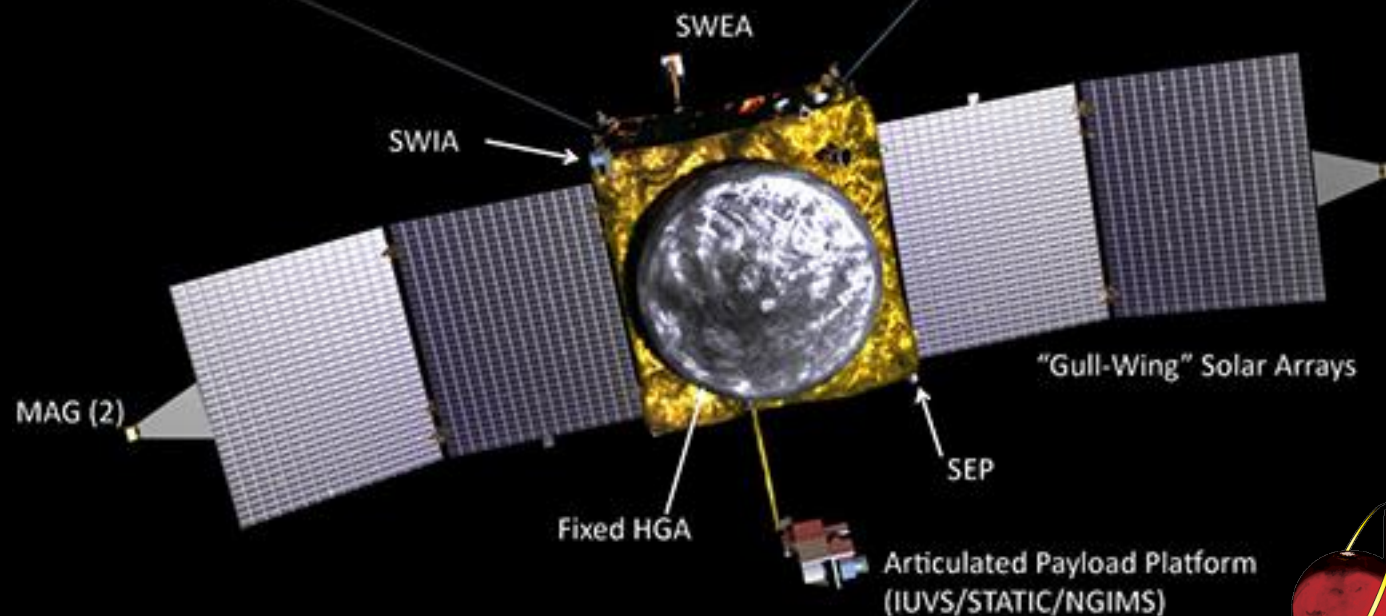


MAVEN will orbit Mars to explore how the sun may have stripped Mars of most of its atmosphere, turning a planet once possibly habitable to microbial life into a cold and barren desert world. Its nine instruments will observe Mars' magnetic field, it's atmosphere and the effect of the Sun on the Planet.



MAVEN consists of nine different instruments that will work together to analyze the red planet's upper atmosphere, how solar activity contributes to atmospheric loss, and the role that escape of gas from the atmosphere to space has played through time.

Together, they will characterize the solar wind and the ionosphere of the planet, determine global characteristics of the upper atmosphere and ionosphere and measure the composition and isotopes of neutrals and ions.



The MAVEN Science Instruments:

Sun, Solar Wind, Solar Storms



SWEA



SEP



EUV



SWIA

Ion-Related Properties and Processes



STATIC

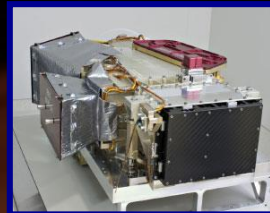


MAG

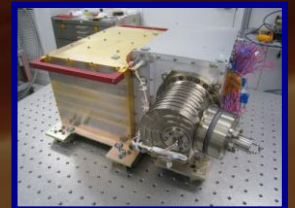


LPW

Neutrals and Ions Plus Evolution



IUVS



NGIMS

These movies discuss three ways in which Mars may have lost its atmosphere:

Neutral processes: <http://youtu.be/wAKuJ03kHUM>

Plasma processes: <http://youtu.be/nWjKlLtQc7A>

Sputtering: <http://youtu.be/oJCsQ9KzWpk>



Mars Atmosphere and Volatile Evolution Mission

EDUCATION & PUBLIC OUTREACH
Bringing Mars Science Down to Earth