The Draping Magnetic Field Around Mars

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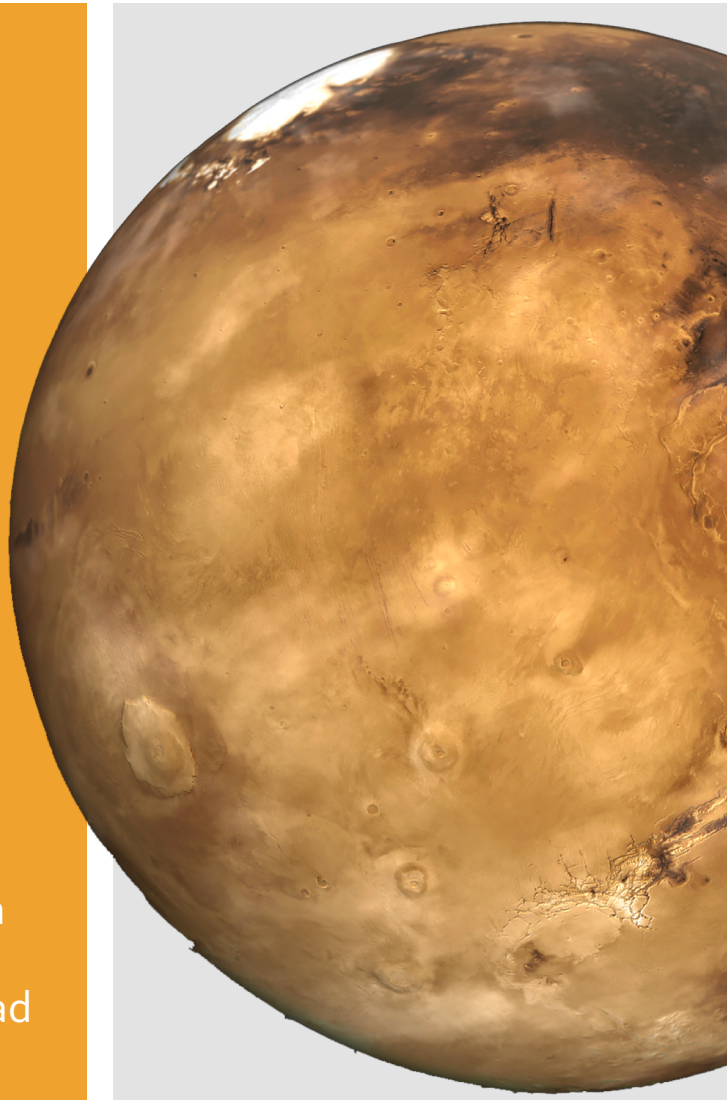
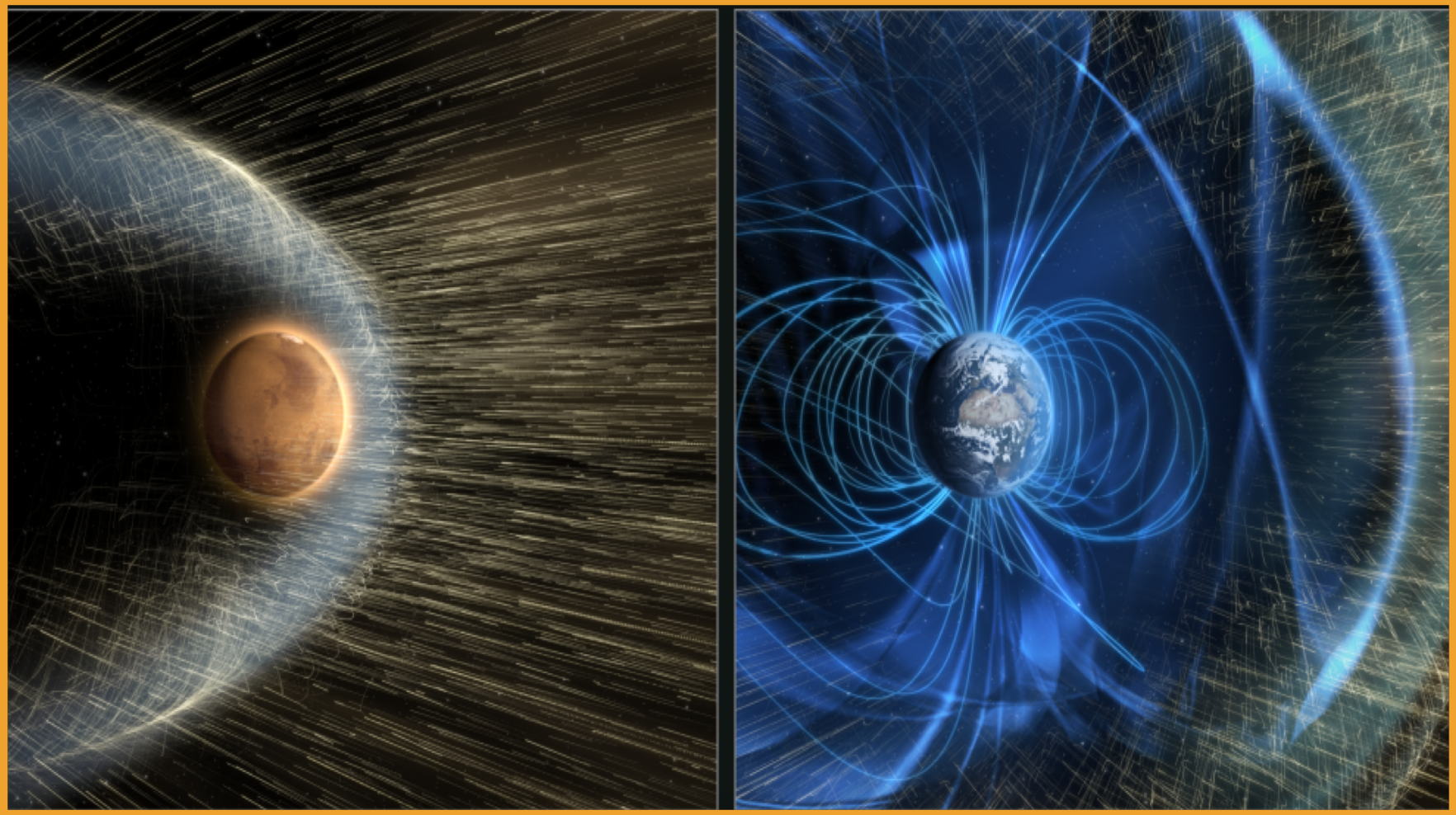
Based in : LASP



Without global magnetic field

With global magnetic field

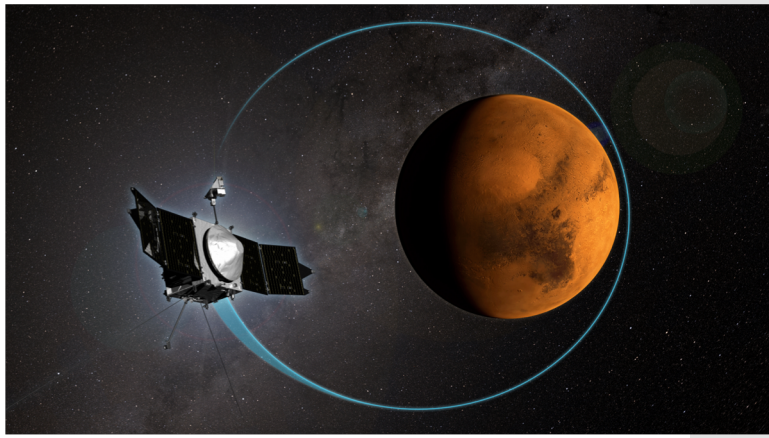


Solar wind

- It is released from the upper atmosphere of the sun, called the corona.
- The practices found in the solar wind are mostly electrons and protons.
- IMF interplanetary magnetic field frozen in the solar wind
- The speed of the solar wind when it hits Mars is 400km/s

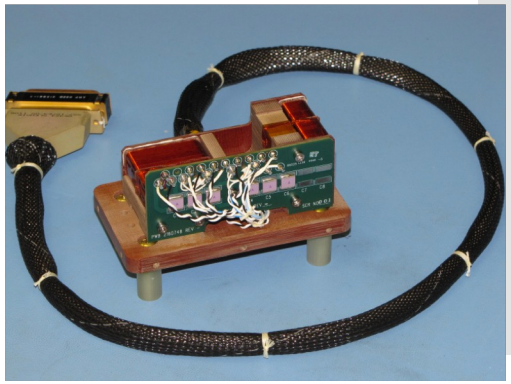
MAVEN

- Stands for:
  - Mars Atmosphere and Volatile Evolution
- Developed by:
  - NASA
- Launch date:
  - November 18, 2013
- Orbital intersection:
  - September 22, 2014



Magnetometer

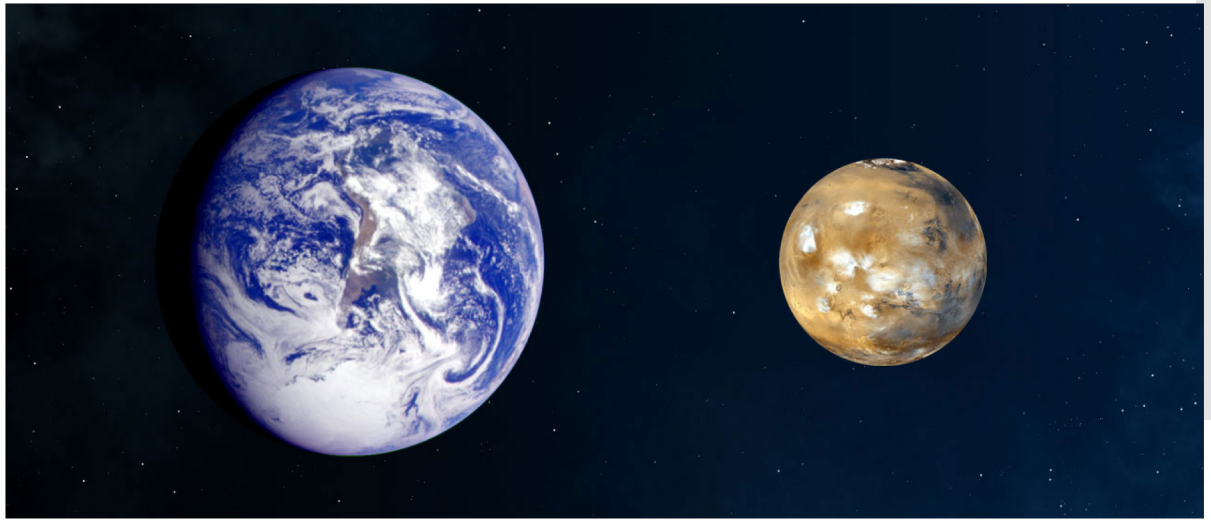
- The Magnetometer (MAG) measures the interplanar solar wind.
- **Observations:**
  - Vector magnetic field in the **unperturbed solar wind** (B ~ 3 nT), **magnetosheath** (B ~ 10-50 nT), and **crustal magnetospheres** (B < 3000 nT), with the ability to spatially resolve crustal magnetic cusps (horizontal length scales of ~100 km)
- Data was used from:
  - November 2014 till October 2017

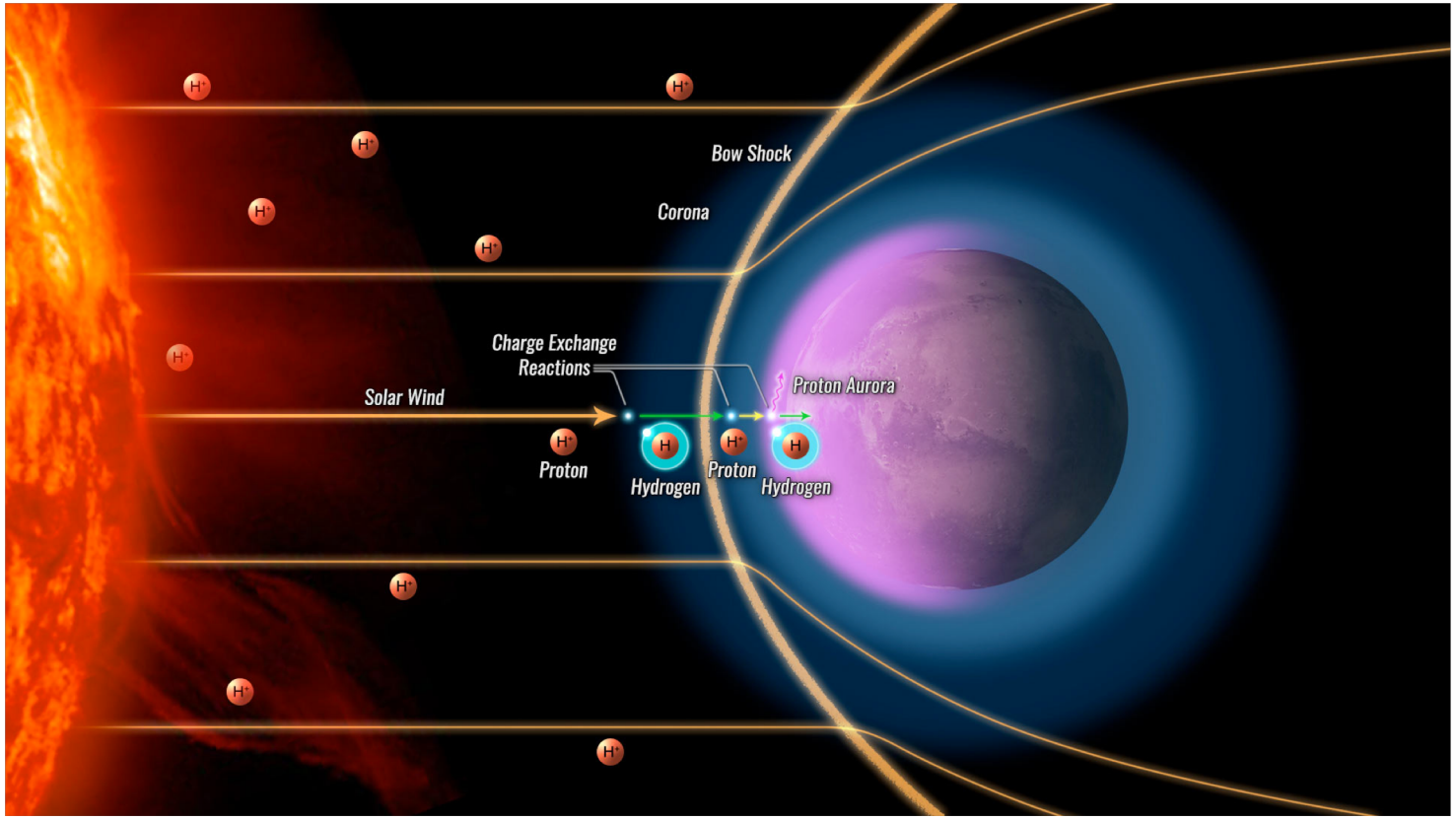


"Magnetometer (MAG)." 10 Earth, Venus, Mars - 1. Accessed August 01, 2018. http://lasp.colorado.edu/home/maven/science/instrument-package/mag/.

Background about Mars

- 141.6 million mi far from the Sun
- Orbital period: 687 days
- Second smallest planet in the solar system
- Its radius is half of Earth's



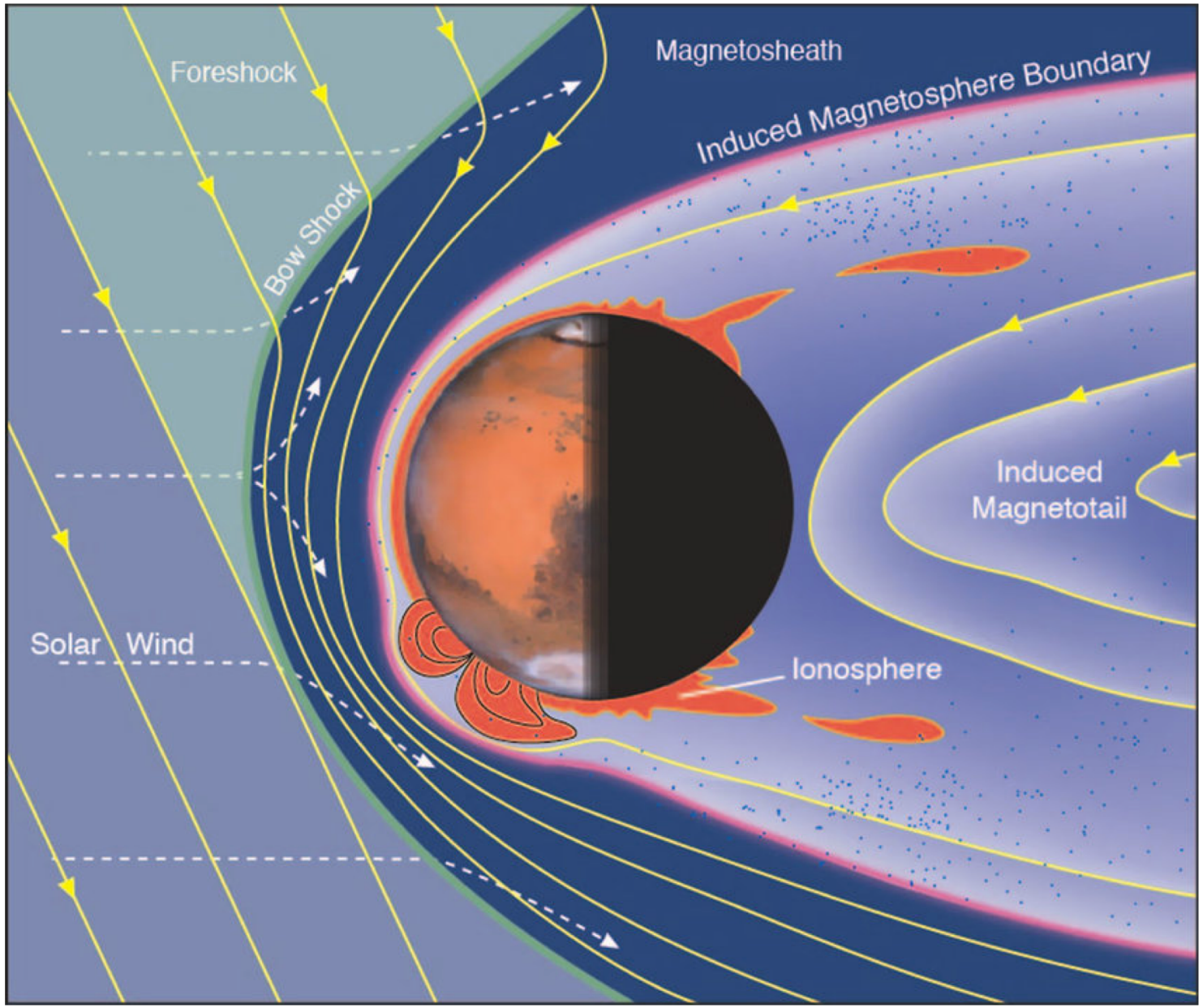


Fun Fact

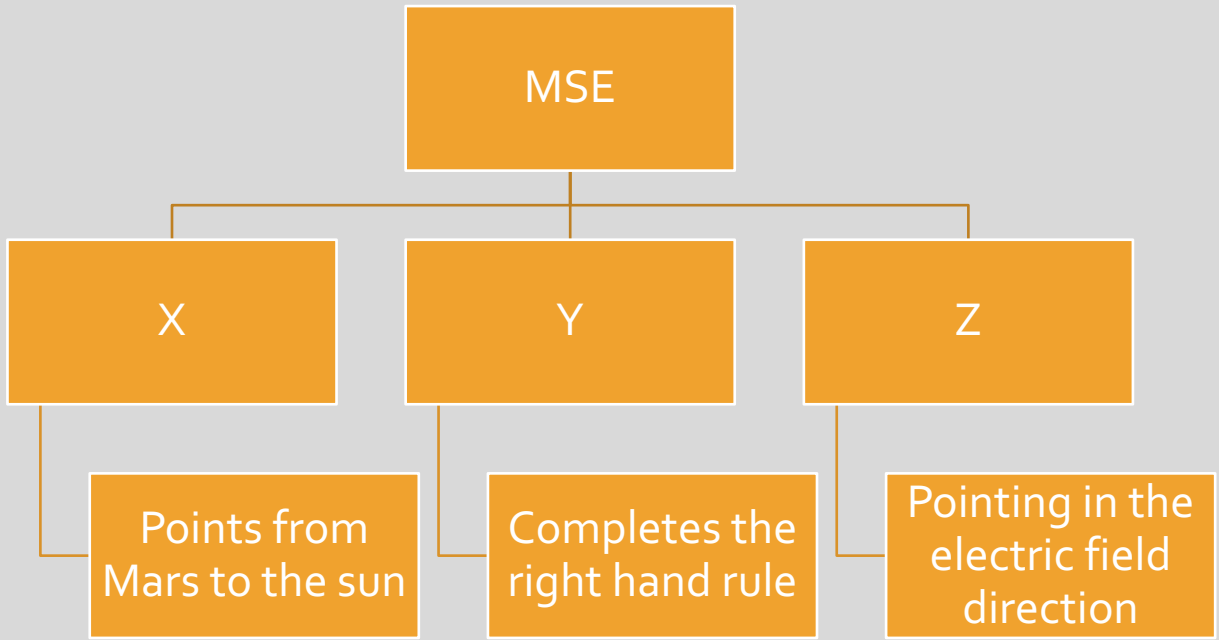
When the solar wind hits mars Aurora happens mostly likely all over the planet at night

Proton Aurora Discovered on Mars | Planetary Science, Space Exploration. (n.d.). Retrieved from http://www.sci-news.com/space/proton-aurora-mars-06231.html

Mars boundaries



Brain, D. A. (n.d.). Solar Wind Interaction And Atmospheric Escape. *15*.


MSE
X
Y
Z
Points from Mars to the sun
Completes the right hand rule
Pointing in the electric field direction

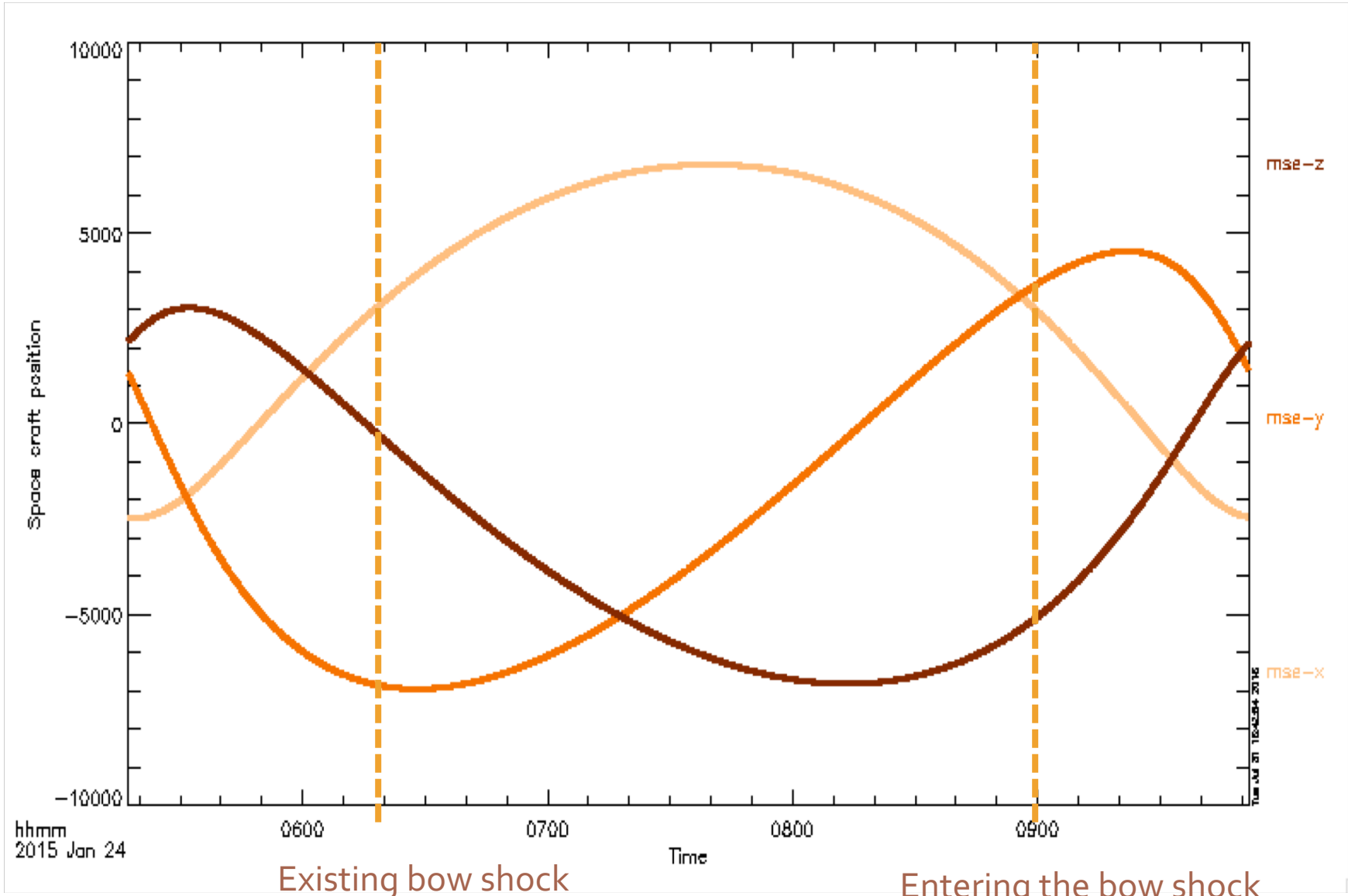
Methodology:

- Time series plots
- 3D plots
- Maps

Time series plot:

- Two time series plots:
  - Spacecraft position
  - Magnetic field data

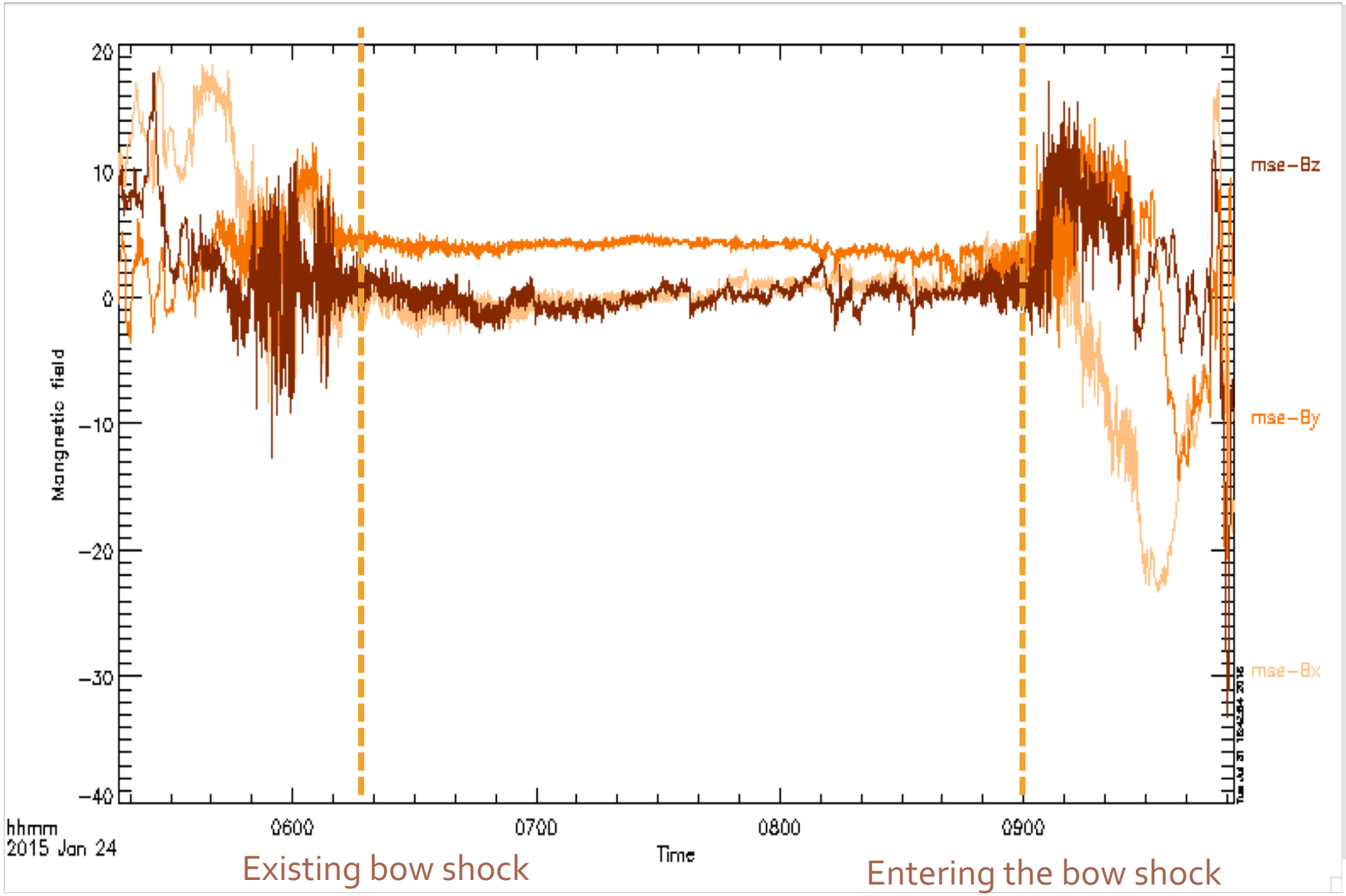
Spacecraft Position time series plot



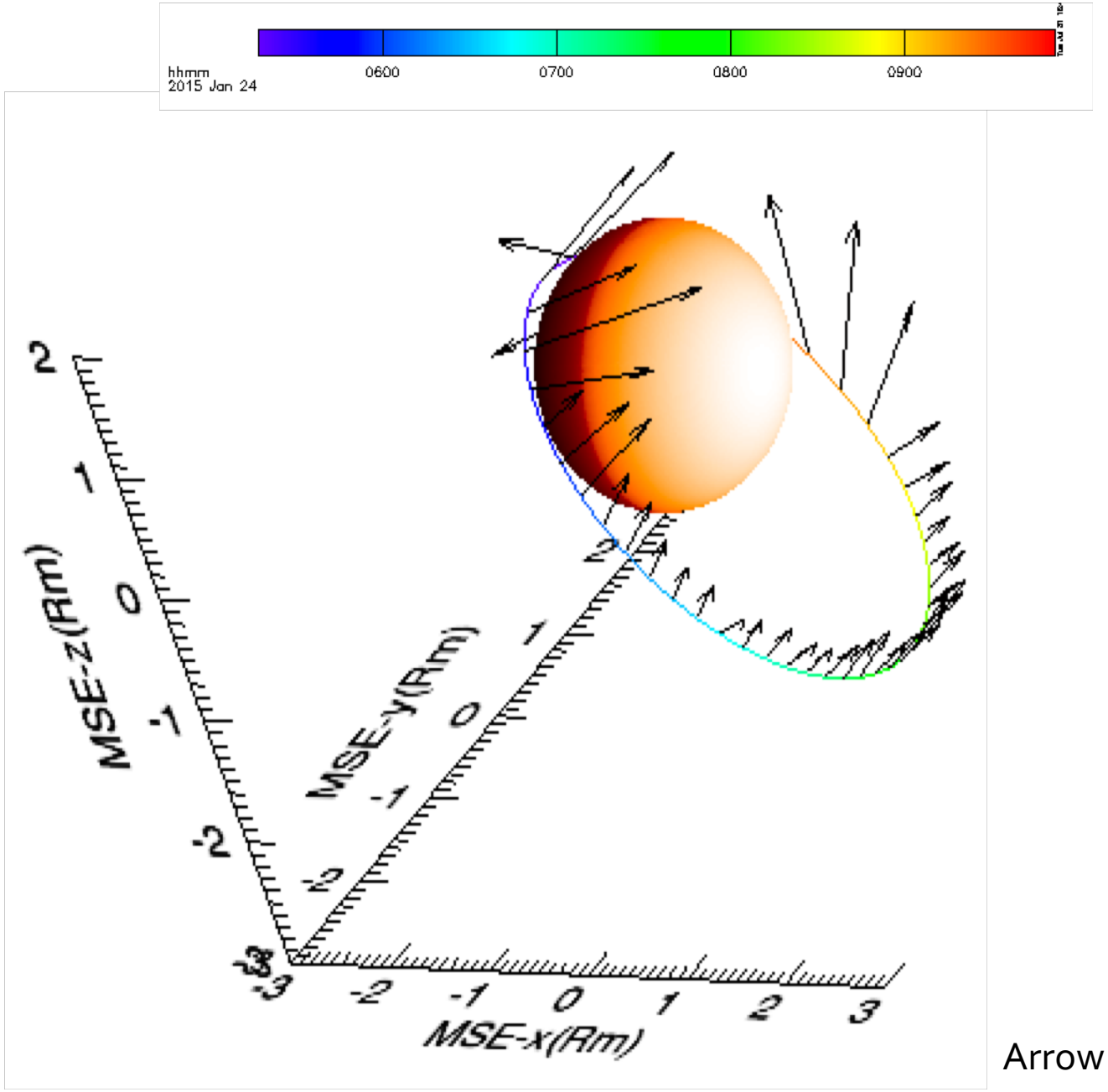
Existing bow shock

Entering the bow shock

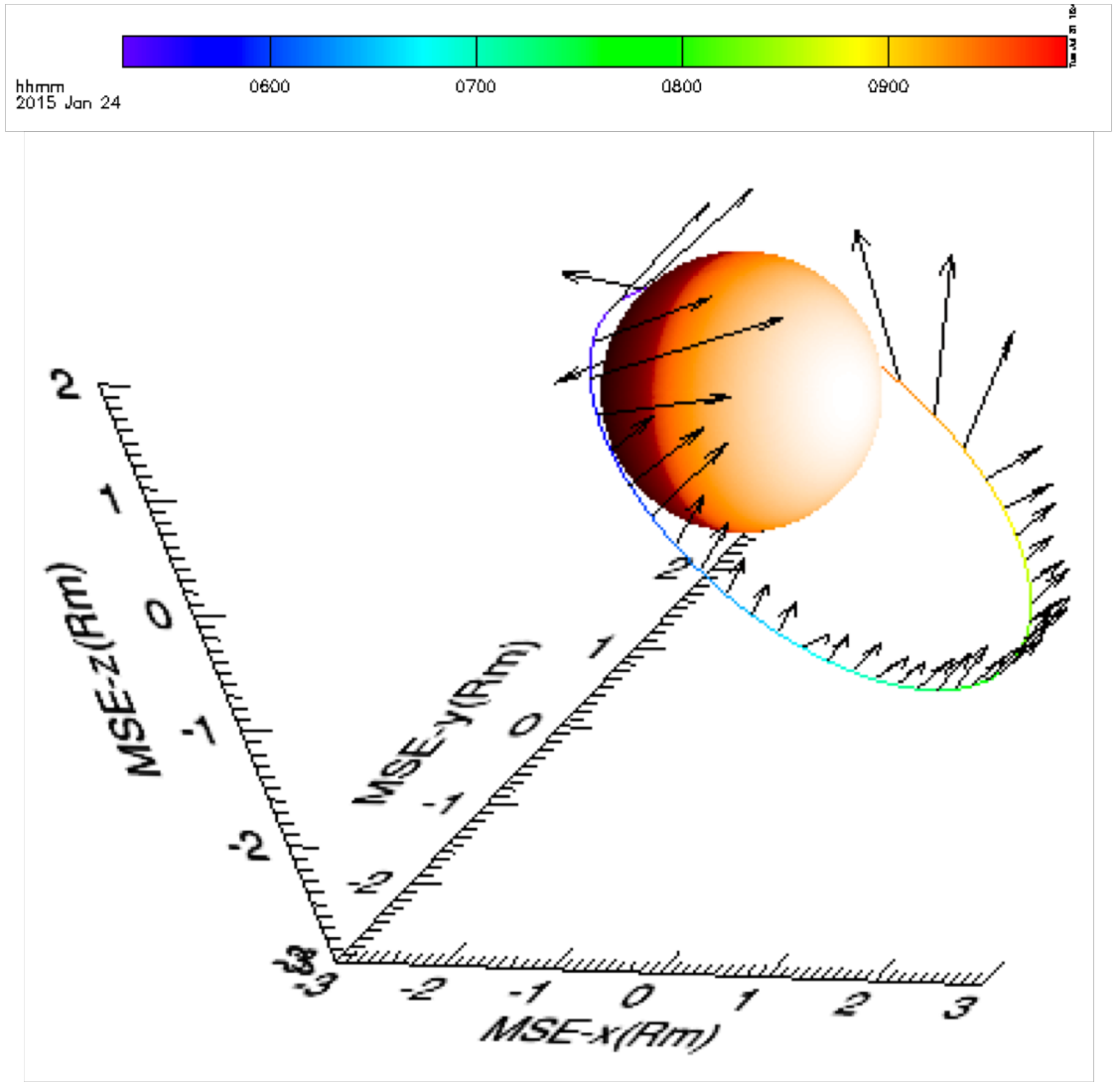
Magnetic field time series plot

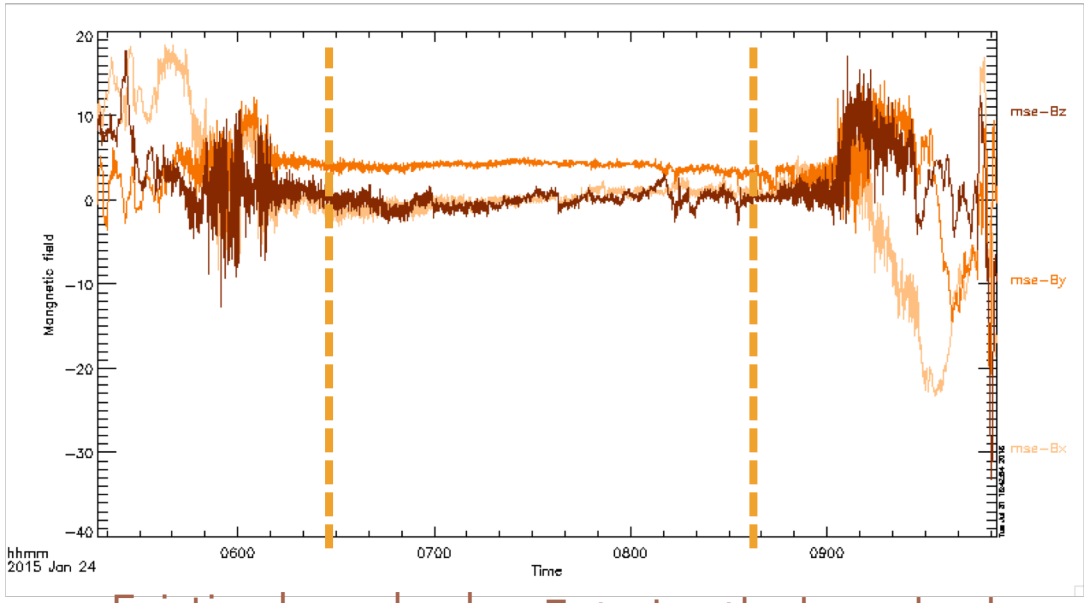


3D plot of one orbital period around Mars



Arrow length: 10 nT



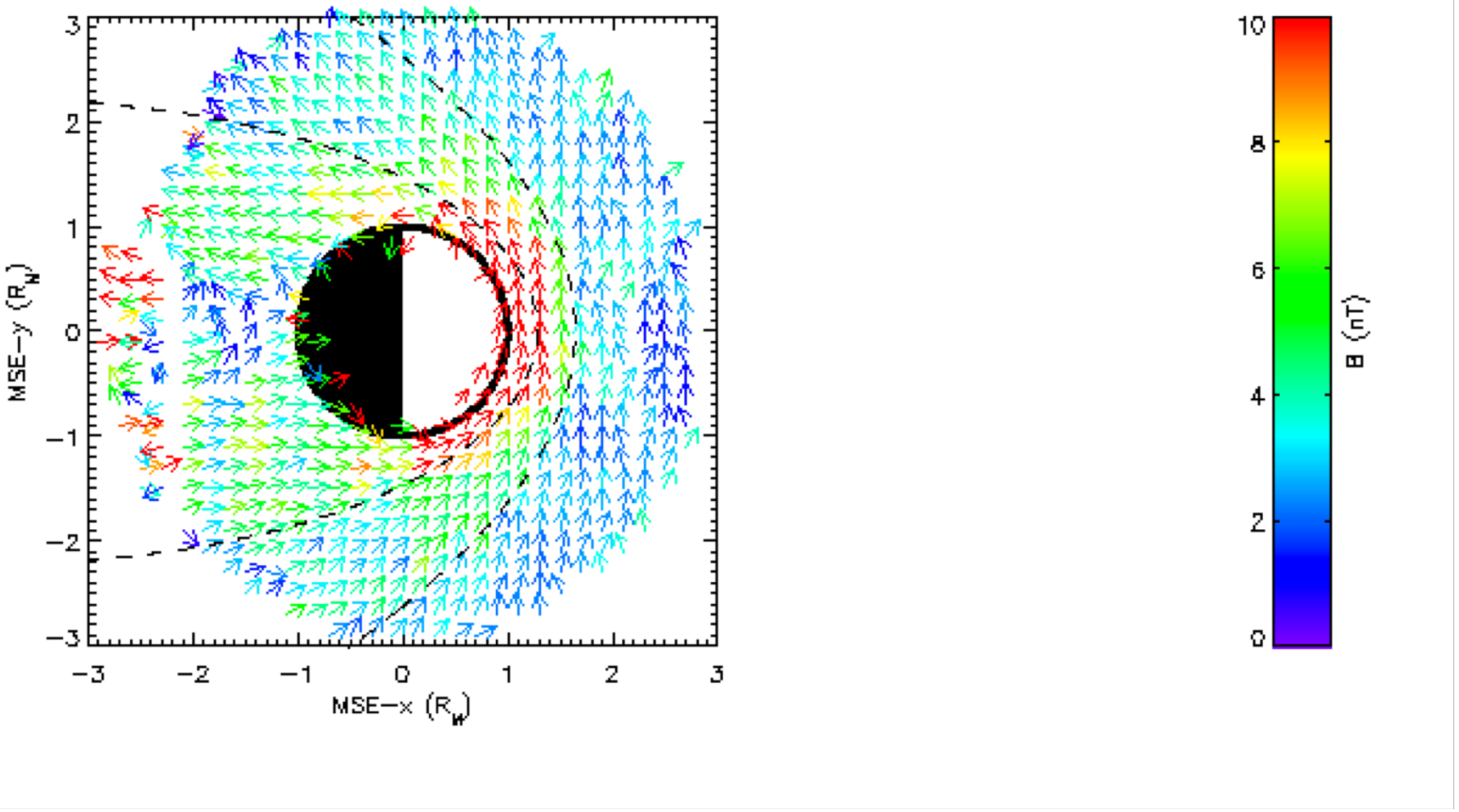


Existing bow shock Entering the bow shock

Map

- Of all the data combined
  - With **weak** solar wind dynamic pressure and IMF
  - With **strong** solar wind dynamic pressure and IMF

Map of the magnetic field around Mars

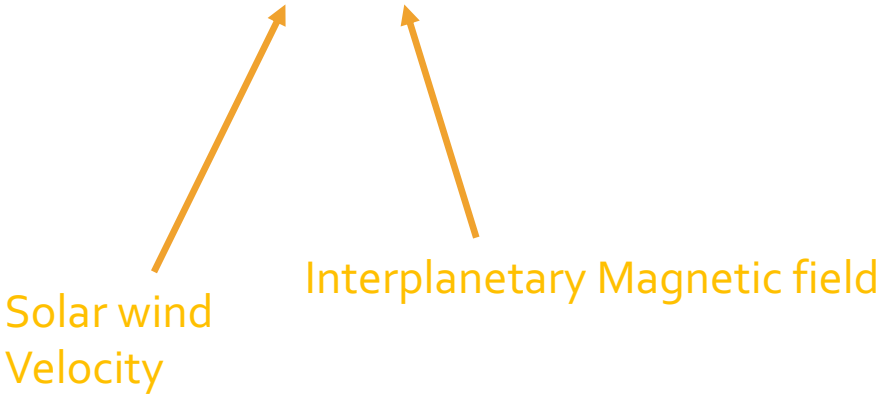


Weak solar wind

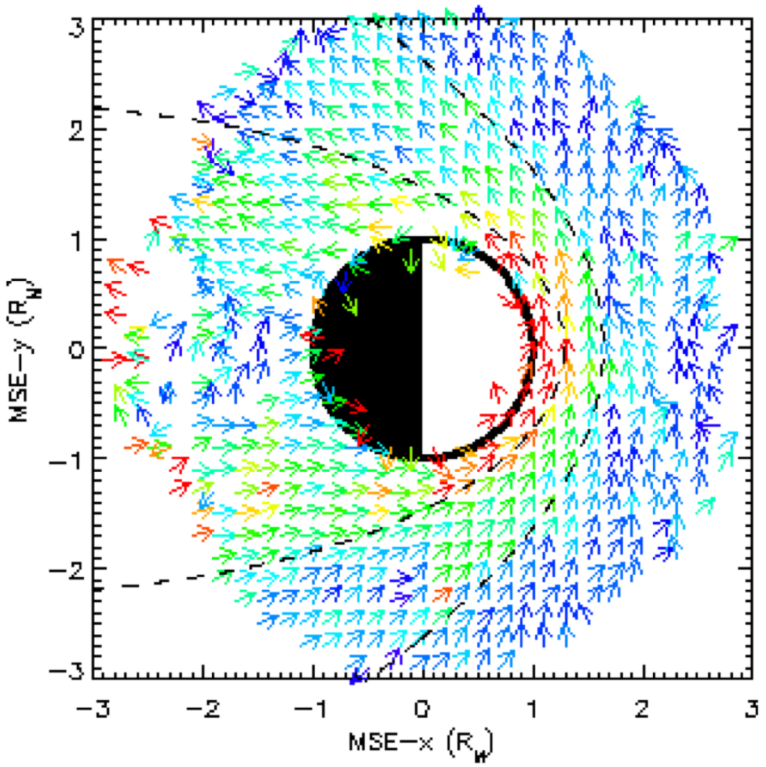
Strong solar wind

Dynamic pressure:

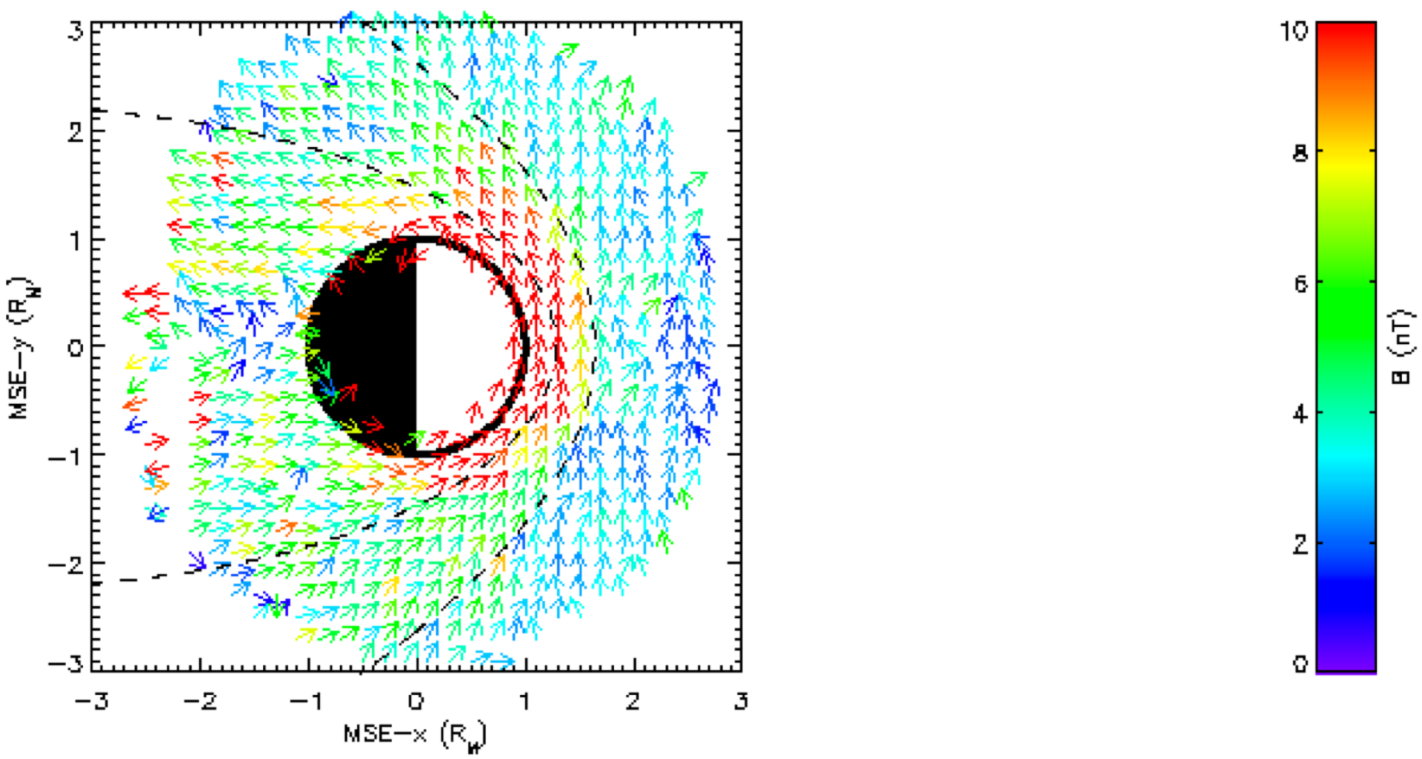
- Dynamic pressure formula:
  - $\vec{E} = -\vec{V}_{sw} \times \vec{B}_{imf}$



Weak Solar wind dynamic pressure
Weak IMF



Strong Solar wind dynamic pressure
Strong IMF



Summary

- Mars doesn’t have a global magnetic field of its own
- The IMF drapes around Mars and results in a magnetic field
- Three methods show the behavior of the magnetic field around mars based on the solar wind pressure and the IMF

Thank You!

Any Questions? ☺