The MAVEN Mission: Exploring Mars’ Climate History

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Evidence for Surface Water on Ancient Mars
Where Did the Water Go? Where Did the CO$_2$ Go?

Abundant evidence for ancient water

Volatile can be lost to space

Volatile can go into the crust

Carbonate deposits in a Martian meteorite

Escaping ions detected from Mars Express

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MAVEN Will Allow Us to Understand Escape of Atmospheric Gases to Space

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The Solar Wind is Able to Strip Off Gas from the Top of the Atmosphere

Video can be found at http://svs.gsfc.nasa.gov/cgi-bin/details.cgi?aid=2962.
The MAVEN Science Instruments:

Sun, Solar Wind, Solar Storms
- SWEA
- SEP
- EUV
- SWIA

Ion-Related Properties and Processes
- IUVS
- NGIMS
- STATIC
- MAG
- LPW

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MAVEN’s primary mission occurs on the declining phase of the solar cycle, when solar storms are most intense and most abundant.
The MAVEN Spacecraft

- Launch (Wet) Mass: 2455 kg at launch
- Spacecraft Dry Mass: 810 kg at launch
- Power: 1135 W at Mars Aphelion
MAVEN Mission Architecture

Launched on 18 Nov. 2013, first day of its 20-day launch period

Ten-Month Ballistic Cruise to Mars

Orbit Insertion: 10 p.m. EDT, 21 Sept 2014 (0200 UTC, 22 Sept. 2014)

One Year of Science Operations

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Mars Orbit Insertion

- MOI will occur on 9/21/14 (ET)
- Sequence activates 3 days out
- 60-day command moratorium begins July 30
- MOI Peer Review, May 1
- Critical Events Readiness Review, 21 July
- MOI #1 ORT between June 3-5
- MOI #2 ORT set for August 5-7
Comet Siding Spring’s Upcoming Encounters with Mars and MAVEN on October 19

- Comet C/ 2013 A1 Siding Spring (C/SS) discovered in January 2013
- Long-period comet on first passage from Oort Cloud
- Siding Spring will pass ~132,000 km from Mars on October 19
- CSS is in a highly inclined, slightly retrograde orbit
- Any dust from CSS that hits MAVEN will have speed of 56 km/s

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Modeling The Dust Environment At MAVEN And Mars

- Dust release from comet and subsequent trajectories can be modeled
  - Three groups independently modeled the distribution of dust particles from comet C/2013 A1 Siding Spring during its close approach to Mars.
  - Mars is at edge of dust cloud – dust may not actually impact spacecraft
  - Risk is thought to be relatively small today – possibly less than background dust
  - Risk not negligible – things can happen that do not show up in images or models

- MAVEN will take steps to mitigate risk
  - Phase location in orbit so that Mars shields us during time of peak risk
  - Orient with minimum cross-section toward dust ram direction
  - Instruments off or in safe state

- Science observations planned, assuming smooth transition phase
  - IUVS spectral imaging of comet 2 days before encounter
  - Full-science observations of upper atmosphere for ~2 days before and ~2 days after encounter, to get before and after views
MAVEN Particles and Fields: Exploring the Solar Wind Beyond 1 A.U.

Solar Wind Density Compressions at Earth and at MAVEN

Solar Energetic Particle (SEP) fluxes at Earth and at MAVEN

Colors show the same dates on both graphs; dates are given in right chart only

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Solar wind data from MAVEN SWIA (J.S. Halekas) and OMNIWeb (N. Papitashvili), SEP fluxes from MAVEN SEP (D. Larson) and ACE EPAM (R. Golvan)
MAVEN’s UltraViolet Imaging Spectrograph (IUVS) Gets Its First View Of Mars

- MAVEN/IUVS First Mars Spectrum
  - Mid-UV wavelength (approx): 190nm to 350nm

- IUVS observations of Mars in May, when Mars filled less than one pixel
- Most features are solar spectral lines, reflected from the planet’s atmosphere.

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MAVEN Current Status

• 241 days into flight as of today (9 July 2014)
• 64 days until Mars Orbit Insertion
• Cruise check-out of spacecraft and instruments is complete
• Instruments have been collecting data during cruise; instruments now off until after MOI
• All systems are operating nominally
• There are lots of events that still need to occur successfully, but…

We are on track to carry out our science mission as planned!