MAVEN Project Status And Science Highlights

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Overall Project Status

MAVEN
Mars Atmosphere and Volatile Evolution Mission
CU/LASP • GSFC • UCB/SSL • LM • JPL

- Spacecraft and instruments continue to operate nominally and to produce "Level 1" science measurements.
- No significant anomalies that affect science
  - Diagnosis and resolution of "hiccup" with IMU-1 ongoing, currently on IMU-2 and planning to switch back to IMU-1 shortly
  - Development planned for "all-stellar" mode using star trackers, as backup to IMUs
- Currently operating in Extended Mission #4
  - Oct 2019 – Sep 2022
  - Funding approved and in place for FY2020 (current year), planning proceeding for FY2021 and FY2022
  - Significant budget cuts relative to senior-review proposal a year ago require significant downsizing of science team, starting this year and each year into the future
- Aerobraking successfully carried out early in 2019
  - Reduced apoapsis from ~6200 to ~4500 km altitude
  - Put us into orbit that improves relay performance, including direct coverage of Mars 2020 EDL
- Relay support for rovers/landers ramping up
  - Currently up to ~1 relay/day, expected to increase to 2-3/day after Mars 2020 arrives
  - Science to continue on remaining 3-5 orbits/day

Plans for Extended Mission-4

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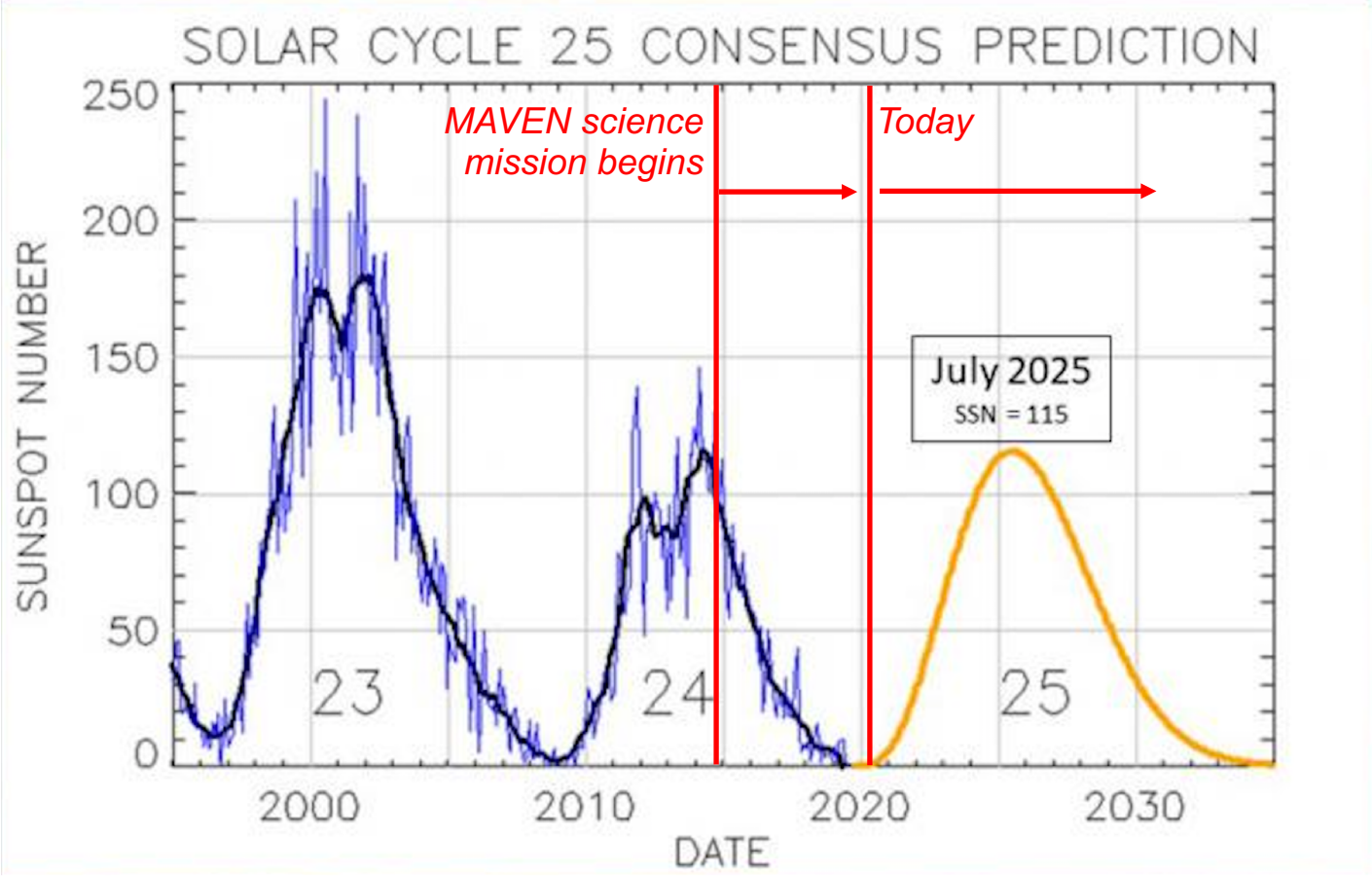
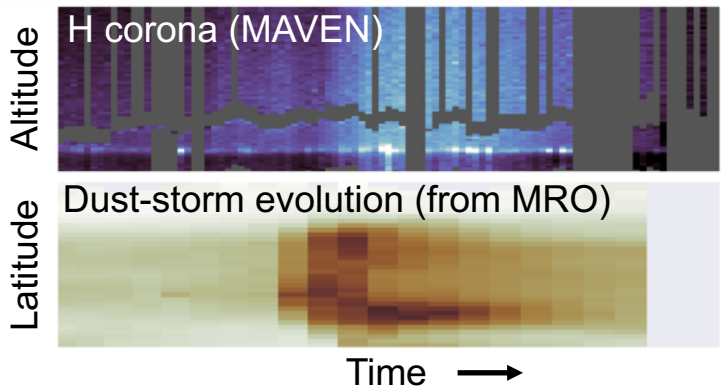
- Science observations continue on non-relay orbit segments
  - Full range of nominal observations
  - Special observations continue, including:
    - NGIMS wind scans
    - NGIMS high-altitude argon scans
    - IUVS stellar occultations
    - New sequences to improve resolution of SWEA, SWIA, SEP
  - No further deep-dip campaigns planned due to impact on fuel consumption and "aerobraking" of orbit
  - Real synergies with other missions, including TGO, MRO, upcoming EMM
- Plan to raise periapsis this summer to decrease fuel usage
  - Minimum altitude will be raised to ~180 km (from current ~150 km)
  - Will no longer control orbit to put periapsis at a specific atmospheric density; gravity/topography will cause periapsis altitude to vary from ~180-230 km
  - Impact on science due to no longer sampling as large a vertical extent of upper atmosphere most of the time
  - Fuel exhaustion date pushed out to beyond 2030
- Currently observing at solar minimum, new cycle beginning and will reach solar max in ~2025

Sun Currently At Solar Minimum, MAVEN Will Observe Rise To Solar Maximum

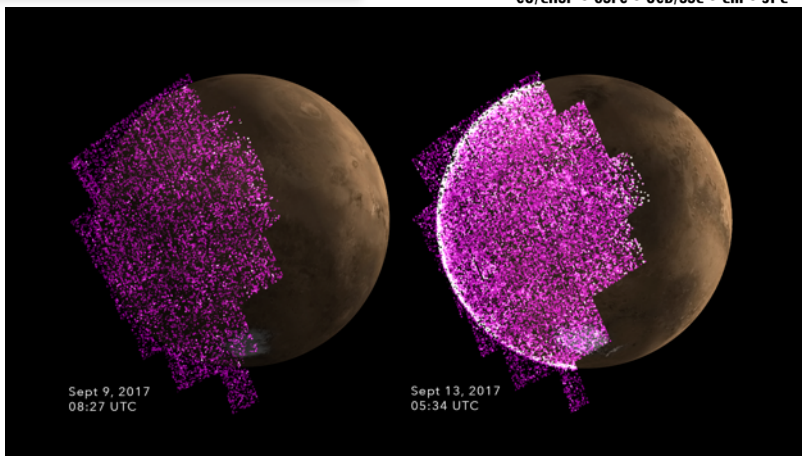


- MAVEN has observed from just past the peak in the previous solar cycle to solar minimum
- Observations between through 2025 will include key period of rise of the solar cycle and solar maximum

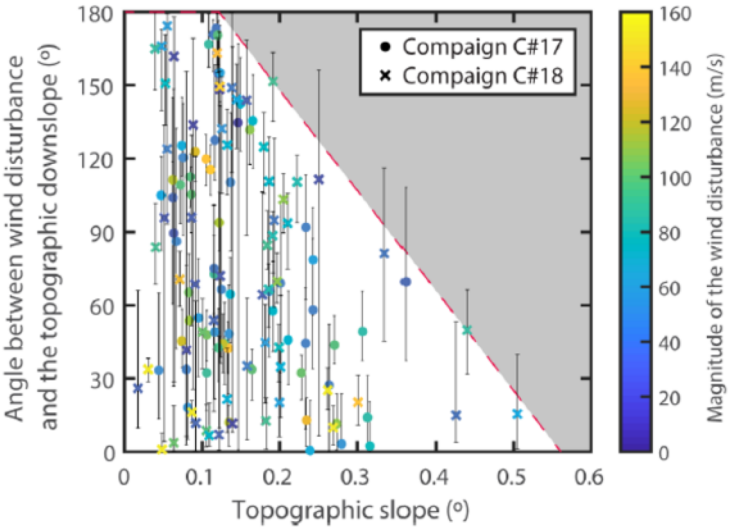
Recent MAVEN Science Highlights (1 of 2)



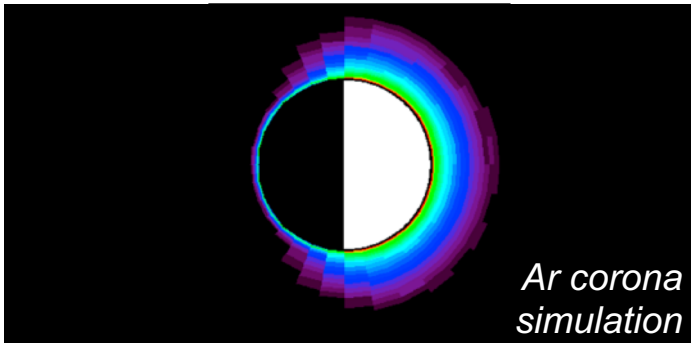
Dust storms drive water into the upper atmosphere, increasing hydrogen corona densities and H escape (Chaffin et al., 2020)



Diffuse aurora before (left, showing only noise) and during a major solar event, an example of strong influence of Sun on upper-atmosphere system and escape (Schneider et al., 2018)

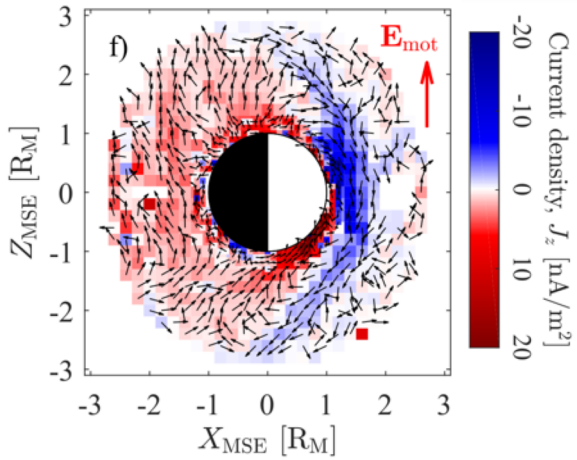


First-time measurement of upper-atmospheric winds shows strong correlation of winds with surface topography, showing coupling to lower atmosphere (Benna et al., 2019)

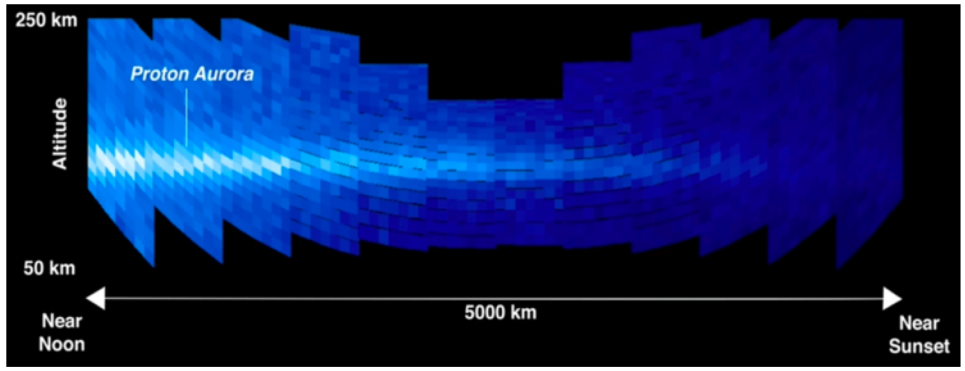


New measurements of energetic high-altitude argon atoms that result from collisions with oxygen at lower altitudes, help to define structure and behavior of extended corona (Leblanc et al., 2020)

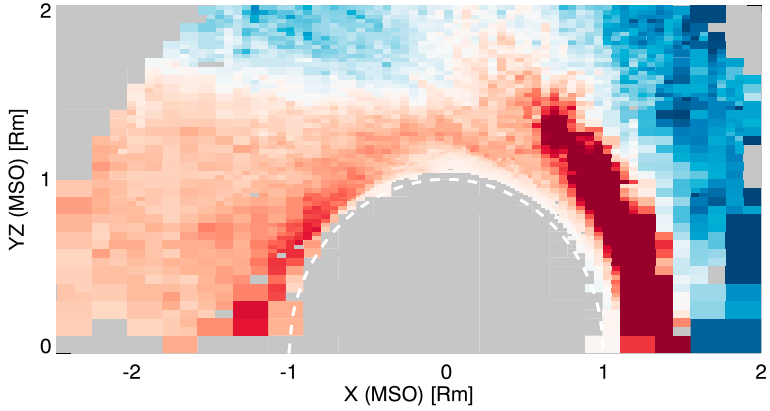
Recent MAVEN Science Highlights (2 of 2)



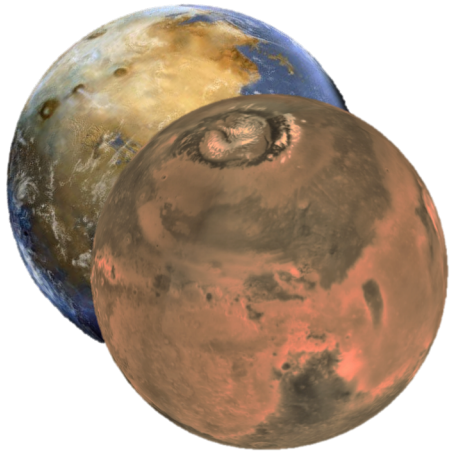
First determination of global system of electrical currents in the Martian magnetosphere, as derived from magnetic-field data (Ramstad et al., 2020; Collinson et al., 2020)



Discovery of proton aurora due to solar-wind protons penetrating into neutral upper atmosphere (Deighan et al., 2018)



Regions of space that are magnetically connected to the surface and ionosphere (shown in red), derived from electron and magnetic-field data (Xu et al., 2019; Weber et al., 2019)



Determination of integrated escape shows that the majority of Mars' CO_2 has been lost to space, driving changes in climate through time (Jakosky, 2019)