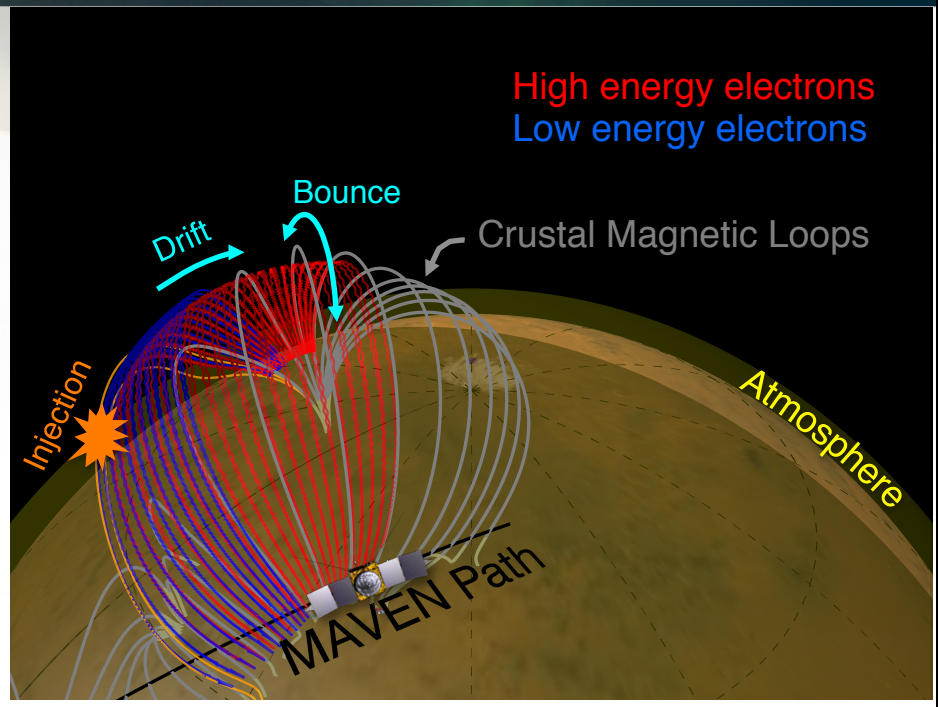
NASA's MAVEN Finds Dynamic Electrons at Mars

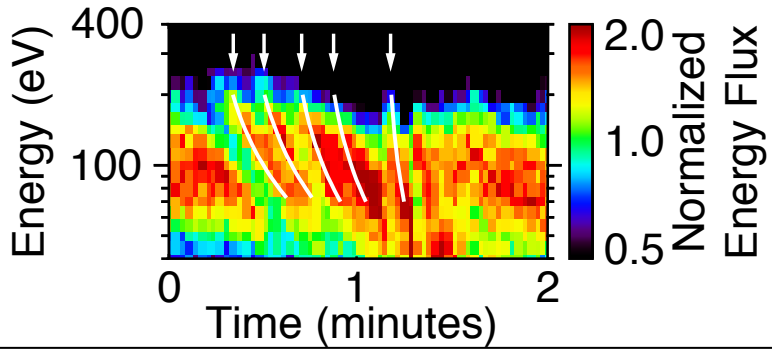
The Mars Atmosphere and Volatile EvolutioN (MAVEN) mission observes the dispersal of electrons in the vicinity of strong Martian crustal magnetic fields similar to processes seen in the global magnetic field at Earth.

Mars lacks a global dynamo magnetic field like Earth, but it is instead covered by dozens of inhomogeneous and locally strong crustal magnetic "umbrellas". These strongly magnetized regions in Mars' crust produce magnetic field loops that extend above the atmosphere. MAVEN observes electrons bouncing rapidly back and forth along the loops and drifting more slowly across them as they bounce (top figure).

The high energy electrons are always observed before low energy electrons (bottom figure). In a recent paper, *Harada et al.* (2016) interprets this to mean that electrons are injected onto crustal fields far from the spacecraft, then drift to MAVEN. Because high energies drift faster, this would explain why high energies are observed to arrive first. Additionally, many distinct electron injection events are observed over a short period (bottom figure).

The data suggest that particles are supplied to crustal fields on short timescales and in non-steady ways. These dynamic injection and dispersion processes, observed in the Earth's global dipole field on a planetary scale, thus also are active on much smaller scales in Mars' mini-magnetospheres.





Harada, Y., et al. (2016), MAVEN observations of energy-time dispersed electron signatures in Martian crustal magnetic fields, Geophys. Res. Lett., 43, 939–944, doi:10.1002/2015GL067040.