MAVEN OBSERVATIONS OF THE MARTIAN IONOSPHERE AND MAGNETOSHEATH. D. L. Mitchell, C. Mazelle, J. P. McFadden, D. Larson, J. S. Halekas, J. E. P. Connerney, J. Espley, L. Andersson, J. G. Luhmann, R. J. Lillis, M. Fillingim, T. Hara, and D. A. Brain, Space Sciences Laboratory, University of California, Berkeley CA 94720 (mitchell@ssl.berkeley.edu), 2L’Institut de Recherche en Astrophysique et Planétologie, 31028 Toulouse Cedex 4, France, 3Department of Physics and Astronomy, University of Iowa, Iowa City, IA 52242, 4NASA Goddard Space Flight Center, Greenbelt, MD 20771, 5Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, CO, 80303.

Introduction: The MAVEN mission is designed to provide a comprehensive picture of the Mars upper atmosphere, ionosphere, solar drivers, and atmospheric loss. Atmospheric escape from Mars can occur through a variety of processes, including photochemical and Jeans escape and sputtering for neutrals, and a variety of mechanisms for ions (see [1] for a review). Many factors control ion escape, including variability of solar drivers (EUV, solar wind, solar storms), as well as the configuration of magnetic and electric fields in the Mars environment. The magnetic environment is strongly influenced by intense crustal magnetic fields [2], which are located predominantly south of the dichotomy boundary and rotate with the planet. Much work remains to be done to clarify which are the most important loss mechanisms, how they relate to each other, and how they depend on external drivers.

The Mars ionosphere is the source region for ion escape, and an understanding of the structure and magnetic topology of the interface between the ionosphere and the overlying magnetosheath and magnetotail is one of the keys to evaluating plasma escape.

Background: MAVEN’s 75-deg-inclination orbit samples the Mars environment from the collisional region of the thermosphere/ionosphere (periapsis altitude ~150 km), through the solar wind interaction region, to the upstream solar wind. (Five "deep-dip" campaigns will provide observations down to ~120 km altitude.) Over the course of the one-Earth-year primary mission, the orbit precesses so that periapsis samples a wide range of local solar times, solar zenith angles, and latitudes. The MAVEN Solar Wind Electron Analyzer (SWEA) is a symmetric hemispherical electrostatic analyzer with deflectors designed to measure the energy and angle distributions of 3- to 4600-eV electrons in the Mars environment. Together with the MAVEN Magnetometer (MAG), SWEA can determine electron energy and pitch angle distributions with high cadence (2 sec, ~8 km along the orbit track). These observations provide unprecedented detail of ionospheric structure and magnetic topology.

Observations:

Preliminary SWEA measurements include: (1) observations of the Martian ionosphere down to 150 km, including first in situ observations of the night-side ionosphere below the exobase; (2) structure of the interface between the magnetosheath and the ionosphere, indicative of waves, streamers, clouds, or time-variable boundary motion, (3) plasma voids and crustal magnetic cusps regions on the night hemisphere, and (4) near-terminator structure of the ionosphere.