SOLAR EUV IRRADIANCE AT MARS: WHY WE'RE MEASURING IT AND WHY YOU SHOULD CARE. F. G. Eparvier[1], E. M. B. Thiemann[1], P. C. Chamberlin[2], and T. N. Woods[1], [1]University of Colorado Laboratory for Atmospheric & Space Physics (3665 Discovery Drive, Boulder, CO 80303; frank.eparvier@lasp.colorado.edu, ed.thiemann@lasp.colorado.edu, tom.woods@lasp.colorado.edu), [2]NASA Goddard Spaceflight Center (Code 671, Greenbelt, MD, 20771; phillip.c.chamberlin@nasa.gov).

Introduction: The solar extreme ultraviolet (EUV) irradiance is a primary energy input to the atmospheres of the planets. Solar EUV light is completely extinguished before reaching the surface of planets that have significant atmospheres. EUV photons are energetic enough to ionize atmospheric constituents, creating ionospheres. EUV light can dissociate molecular species, changing the atmospheric composition and initiating photochemistry. Solar EUV also heats upper atmospheres, giving rise to the hot temperatures in thermospheres.

The solar EUV spectrum consists of emission lines and continua, varying in brightness from wavelength to wavelength by many orders of magnitude. The solar EUV irradiance also varies on all timescales: over years and decades due to the solar magnetic cycle, over days and months due to solar rotation, and over minutes and hours due to solar flares and other eruptive events. Depending on wavelength and source of variability, the solar irradiance can change from a few percent up to several orders of magnitude over these different timescales. The sources of the variability of EUV emissions from the Sun are magnetically driven and are not evenly or even very well predictably distributed about the sphere of the Sun, nor are they well predictable in time of occurance.

The solar EUV irradiance at any given planet at any given time depends on the distribution of source regions on the face of the Sun visible to that planet at a particular time. For instance, during the primary MAVEN mission, Mars will be on the opposite side of the Sun from the Earth. EUV irradiance at Mars may be significantly different in magnitude and distribution with wavelength than what is seen at Earth for any given time during the mission.

Knowing the solar EUV spectral irradiance and how it varies is key to understanding the state and variability of a planetary upper atmosphere. A main goal of the MAVEN mission is to understand the escape of atmospheric species. Understanding escape requires knowing the drivers of ionization, composition, and temperature and their variability; hence the need for an EUV monitor on MAVEN.

This presentation will introduce the solar EUV irradiance and its variability, some of the effects of that variability on the Mars atmosphere, and how, with a combination of measurements and modeling, the MAVEN EUV monitor will provide the necessary characterization of solar EUV irradiance at Mars to meet the missions goals.

The MAVEN EUV Monitor: The constraints of mass, power, telemetry, and budget are all tight on a mission to another planet, making an instrument that measures the full solar EUV spectral irradiance from MAVEN unrealistic. Instead, knowledge about the spectral and temporal variability of solar EUV emissions gained from more complex instruments that have flown in Earth orbit over the last few decades allow us to fly a more simple instrument at Mars. The MAVEN EUV monitor consists of three broadband filter radiometers that are sensitive in the 0.1-7, 17-22, and 121-122 nm wavelength range and will measure at a cadence of 1-second. These wavelengths capture solar emissions from different temperature regions in the solar atmosphere that vary in different ways over the shorter timescales of minutes to days. Slower varying emissions (on the timescales of months to years) will be represented by interpolated proxies measured from Earth and Earth orbit. A solar irradiance proxy model will be used to produce full spectral irradiances from 0 to 190 nm in 1-nm bins at a time cadence of 1-minute. The MAVEN EUV monitor data products will provide the detailed solar spectral irradiance necessary for understanding the input the Mars atmosphere and its variability.