EVOLUTION OF HABITABILITY FOR PLANETS AROUND M-DWARF STARS: APPLICATION OF RESULTS FROM MAVEN AT MARS. M.S. Chaffin[1], D.A. Brain[1], S.M. Curry[2], and B.M. Jakosky[1]. [1]LASP, University of Colorado, [2]SSL, University of California Berkeley.

Orbiting Mars since late 2014, the Mars Atmosphere and Volatile EvolutioN (MAVEN) [1] mission has continuously been making observations of different atmospheric loss processes, correlating the escape rate of the Martian atmosphere to the solar photon and particle drivers that are thought to control such escape. Mars represents the only known planet where atmospheric escape has unambiguously affected planetary habitability, transforming an early warmer, wetter world into the desiccated and frigid state existing today. For exoplanets orbiting M-dwarfs, atmospheric escape may have had a similar adverse effect on habitability; this is all the more likely due to the more intense particle and radiation environments that exoplanets experience in close-in habitable zones [2]. Here we present an overview of current MAVEN results, and will discuss Mars as an analogue for exoplanets undergoing atmospheric erosion. We will discuss how the atmospheric escape processes at a terrestrial planet orbiting a G star on the main sequence can be extrapolated to determine the likely history of habitability on a Mars-like planet orbiting an M-dwarf. Such extrapolations can be accomplished in several ways, including (1) curve-fitting to measured variability in charged particle escape rates as a function of stellar inputs; (2) photochemical arguments and modeling, used to infer variations in neutral escape rates due to changes in atmospheric composition and stellar radiation; and (3) numerical modeling of the stellar wind/planetary interaction using models whose validity has been established through comparison with MAVEN data. In each case, the extrapolation must account for how the escape rates respond to changes in the stellar input spectrum, the stellar wind parameters, and the duty cycle and intensity of extreme stellar events. We will briefly discuss each approach and present the ways in which the MAVEN data can serve as a solar system ground truth, and its relevance to understanding atmospheric escape and planetary habitability.

References: [1] Jakosky, B.M. et al. (2015) *SSR, 195, 1-4*, 3-48. [2] Shields, A.L. et al. (2017) https://arxiv.org/abs/1610.05765 .