TRANSMISSION AND EMISSION COLOR RATIOS FOR EXOPLANET CHARACTERIZATION. K.S. Sotzen,1,2 N.R. Izenberg,1 C.M. Lisse,1 K.B. Stevenson,1 J.J. Linden,1 S.M. Hörst,2,3 N.K. Lewis,4 K.E. Mandt,1 Johns Hopkins University Applied Physics Laboratory, Laurel, MD, USA, 2Johns Hopkins University, Baltimore, MD, USA, 3Space Telescope Science Institute, Baltimore, MD, USA, USA, 4Cornell University, Ithaca, NY, USA. (11100 Johns Hopkins Rd, 200-E530, Laurel, MD 20723, USA, kristin.sotzen@jhuapl.edu)

The majority of exoplanets found to date have been discovered via the transit method, and transmission and emission spectra represent the primary method of studying these distant worlds. Current methods of characterizing transiting exoplanets entail the use of spectrographs on large telescopes, requiring significant observation time to study each planet. However, Crow et al. (2011) showed that color-color reflectance ratios can be used to broadly categorize solar system bodies, and Sing et al. (2016) and Stevenson (2016) showed trends in hot Jupiter water abundances as a function of blue-optical vs NIR/MIR altitude differences and temperature/gravity respectively. Building on these concepts, we are investigating the use of transmission and emission color ratios for coarse categorization of exoplanets (e.g., hot Jupiter, Jovian, ice giant, or Earth-like) as well as assessing the nature and habitability of these worlds. We will present our results to date, including spectrum modeling methods, model comparison frameworks, and waveband selection criteria.

This method could allow for broad characterization of a large number of planets much more efficiently than current methods permit. For example, a TESS follow-on mission could observe multiple band transits to identify exoplanets by category and to break degeneracies between planet size and density (e.g., rocky vs icy). Additionally, data collected via this method could inform follow-up observing time of large telescopes for more detailed study of worlds of interest.

Finally, these data could be used to study planetary system structure for different types and ages of stars, with potentially significant impact to our understanding of planetary system formation and evolution. This information would provide context for our solar system’s formation and dynamical history as well as our commonality with potentially-habitable worlds and systems.

References: