SPACE WEATHERING AND EXOSPHERE–SURFACE INTERACTIONS. Brett W. Denevi[1], Sarah K. Noble[2], David T. Blewett[1], Roy Christoffersen[3], Jeffrey J. Gillis-Davis[4], Benjamin T. Greenhagen[1], Amanda R. Hendrix[5], Dana M. Hurley[1], Lindsay P. Keller[3], and Michelle S. Thompson[3]. [1]Johns Hopkins Applied Physics Laboratory, Luarel, MD 20723, USA, [2]NASA Headquarters, Washington, DC 20546, USA, [3]NASA Johnson Space Center, Houston, TX 77058, USA, [4]University of Hawaii, Honolulu, HI 96822, USA, [5]Planetary Science Institute, Tucson, AZ 85719, USA.

Introduction: Advances in understanding space weathering and how exosphere–surface interactions alter the Moon's uppermost surface include both new laboratory work and new types of remote sensing measurements. The goal of this chapter will be to provide a broad overview of these innovations, as well as to integrate observations from the micro-scale (such as studies that focus on a single particle of soil) to the macro-scale (such as regional trends in space weathering). Since the Moon provides much of our foundational knowledge of space weathering processes, we aim to place our understanding of lunar space weathering in the context of recent advances elsewhere in the Solar System.

Chapter Outline: The chapter will start with an overview of the variety of processes that are included as part of space weathering, how the definition has changed and expanded, and a description of the significance of space weathering for wider lunar science questions. It will then cover recent laboratory advances, including analogs (e.g., studies of silica gels, laser, ion bombardment, and impact studies) and samples (e.g., single impacts, oxidation state of nanophase iron, agglutinates, and rates as inferred from solar-flare track densities). Recent remote sensing work both expands the wavelength range for examining space weathering (from the far-ultraviolet out to thermal infrared and even radar wavelengths), and provides new insight from high spatial- and spectral-resolution observations in the visible through near-infrared. Observations of space weathering trends in regions of reduced solar wind flux (magnetic anomalies, high latitudes) provide a means to understand the relative rates and influences of the solar wind and micrometeoroid bombardment. And finally new processes of space weathering have been proposed, such as dielectric breakdown that may occur in the poorly conducing regolith at cold temperatures. A synthesis of these topics will provide a means for evaluating important outstanding questions, such as the role of the solar wind, the origin of lunar swirls, rates of weathering, and paths forward for making significant progress toward a better understanding of space weathering across the Moon and across the Solar System.

Changes: Changes since the last New Views of the Moon 2 meeting include the addition several authors and minor updates to the outline.