METEOROID STIMULATED SYNTHESIS OF WATER ON THE MOON. B. M. Jones$^{1,2}$, J. D. Carrillo-Sánchez$^{3,4}$, D. Janches$^5$, M. Sarantos$^6$, T.M. Orlando$^{1,2,6}$. $^1$School of Chemistry and Biochemistry, Georgia Institute of Technology, Atlanta, GA, $^2$Center for Space Technology and Research, Georgia Institute of Technology, Atlanta, GA, $^3$Catholic University of America, Washington, DC, $^4$Ionosphere-Thermosphere-Mesosphere Physics, NASA Goddard Space Flight Center, Greenbelt, MD, $^5$Heliophysics Science Division, NASA Goddard Space Flight Center, Greenbelt, MD, $^6$School of Physics, Georgia Institute of Technology, Atlanta, GA

**Introduction:** As has been verified numerous times, water is on the moon. Some observations of water on the moon include the Moon Mineralogy Mapper (M3) [1], Visual and Infrared Mapping Spectrometer (VIMS) [2], Deep Impact Extended Investigation (DIXI) [3], and Lunar Crater Observation and Sensing Satellite (LCROSS) [4]. Moreover, molecular water has been detected on the lunar dayside surface via the unique 6µm fundamental HOH bending mode [5]. The above observations document the existence of water on the lunar surface, but not the origin. We propose that a portion of this water is formed from recombinative desorption (RD) of solar wind implanted hydroxyls driven by impact with meteoroids.

**Methods:** The kinetics of solar wind implanted defects were modelled with a simple reaction scheme described below. First, protons will implant in the regolith resulting in subsurface hydroxyls. Some of these subsurface hydroxyls will then diffuse to the surface where they may react to form gas phase water. The remaining subsurface and surficial hydroxyls are subject to temperatures high enough to melt a fraction of the regolith (Figure 1) upon impact and will consequently form water as has been demonstrated experimentally [6, 7].

**Results:** The water production rate from impact melt begins to dominate near the poles after ~ 120 years (Figure 2). This is a consequence of temperature-controlled diffusion and RD in the equatorial region limiting the available number of hydroxyl sites for water formation. Near the poles, diffusion is effectively shut off allowing for a buildup of hydroxyl sites over time that are converted to water following an impact event. Because water formation is occurring near the poles, water made from impacts will contribute more to the shadowed crater regions than water made from RD in the equatorial region.


**Acknowledgments:** This work was directly supported by the NASA Solar System Exploration Research Virtual Institute (SSERVI) under cooperative agreement numbers NNA17BF68A (REVEALS).