DEVELOPMENT OF A DUST IMPACT MONITOR FOR EXPLORATION OF THE INNER HELIOSPHERE. K. Johnson[1], K. Fortier[1], C. Nie[1], L. Hurst[1], D. Malaspina[2], and Z. Sternovsky[1,,2], [1]Aerospace Engineering Sciences, University of Colorado, Boulder, CO 80309, [2]Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder, CO 80303.

Introduction: An engineering prototype for a low-power, low-mass Dust Impact Monitor (DIM) is being developed by an undergraduate team at the University of Colorado. The DIM is designed to characterize the dust environment between the Sun and 0.3 AU, a region soon to be explored by the ESA Solar Orbiter and NASA Solar Probe Plus missions. The instrument will be capable of mapping out the spatial distribution of dust in this region as a function of distance from the Sun, utilizing the impact ionization technique.

To date, no in-situ measurements of dust particles have been attempted within a distance of 0.3 AU from the Sun. This near-Sun environment poses many design and operational challenges. The DIM has been designed to survive extreme temperature swings while operating on less than 200 mW of power and with a mass of approximately 200 grams.

An impact monitor is valuable for any mission exploring the inner heliosphere as it can assess the hazards posed by high-velocity micrometeoroid impacts on a spacecraft operating near the Sun. A dust monitor can measure the level of risk future spacecraft assume when traveling in a particular region of the heliosphere. Dust particles can also affect data collection of various in-situ instruments, such as electric field sensors. The coupling mechanism between impact ionized dust and the electric field sensors is poorly understood. As an example, an impact monitor flown on a spacecraft with electric field sensors can help to cross-calibrate the two methods of dust detection.

Immediate results from such an instrument in this region would provide data to benchmark currently used dust transport models. Presently, these models have to be extrapolated from a distance of 1 AU. For missions like Solar Orbiter and Solar Probe Plus, a dust impact monitor would be valuable for invesitgating macroscale physical processes in the heliosphere. Dust particles are known to contribute to mass loading of the solar wind, impacting the acceleration of the solar wind plasma. Impact monitor data could be used to assess the contribution of mass loading by dust particles on the acceleration of the solar wind, and to quantify both the spatial distribution and sunward transport of near-Sun interplanetary dust.