Abstract

We report the development of the Nano-Dust Analyzer (NDA) instrument and the results from the first laboratory testing and calibration. The two STEREO spacecrafts have indicated that nano-sized dust particles, potentially with very high flux, are delivered to 1 AU from the inner solar system [Meyer-Vernet, N. et al., Solar Physics, 256, 463, 2009]. These particles are generated by collisional grinding or evaporation near the Sun and subsequently accelerated outward by the solar wind. The temporal variability and directionality are governed by conditions in the inner heliosphere and the mass analysis of the particles reveals the chemical differentiation of solid matter near the Sun. NDA is a highly sensitive dust analyzer that is developed under NASA's Heliophysics program. NDA is a linear time-of-flight mass analyzer that was modeled after Cosmic Dust Analyzer (CDA) on Cassini and the more recent Lunar Dust EXperiment (LDEX) for the upcoming LADEE mission to the Moon. The ion optics of the instrument is optimized through numerical modeling. By applying technologies implemented in solar wind instruments and coronagraphs, the highly sensitive dust analyzer will be able to be pointed towards the solar direction. A laboratory prototype is built, tested, and calibrated at the dust accelerator facility at the University of Colorado, Boulder, using particles with 1 to over 50 km/s velocity. Calculations of dust flux, direction from which the dust reaches the spacecraft, and velocity range allow for the optimization of performance in the solar environment. The necessary orientation with respect to the Sun, and the progress in mitigating solar effects have been addressed.