ROCKET-BORNE INSTRUMENT TO DETECT CHARGED SMOKE AND CLOUD PARTICLES IN THE MESOSPHERE

Robertson, S., Horanyi, M., Sternovsky, Z.
Dept. of Physics, University of Colorado, Boulder, CO 80309, USA

A rocket-borne instrument has been developed to detect charged, sub-visible aerosol particles in the polar mesosphere. The instrument is designed to fly on a sounding rocket and has a 30 square centimeter entrance slit. Venting ports are placed lower on the detector in order to let the air out and reduce pressure buildup inside the detector. The air sample flows between four pairs of graphite electrodes biased symmetrically with increasing bias potentials. Electrons, light ions (less than 200 amu), cluster ions (200 amu - 1,500 amu) and heavy charged aerosol particles (1,500 - 200,000 amu coresponding to 0.85 - 2 nm radius) of both polarities are collected mass-selectively on the electrodes that are connected to sensitive electrometers. Direct Simulation Monte Carlo (DSMC) codes have been used to optimize the supersonic airflow around the instrument. The design of the entrance slit reduces the effect of the shock on the motion of the aerosols. A separate code is used to model the motion of charged particles within the detector. The effect of collisions with the residual gas is modeled using Monte Carlo techniques and collection efficiency is calculated. A laboratory prototype of the instrument has been fabricated and is currently under testing and calibration using ion beams. The instrument is designed to return data on the mass distribution of PMSE particles in the polar summer mesosphere, and data on meteoritic smoke particles in the polar winter mesosphere. Data from a summer 2007 flight will allow comparisons with remote sensing data from the Aeronomy of Ice in the Mesosphere (AIM) satellite.

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1. (a)
   Scott Robertson
   Dept. of Physcs UCB 390
   University of Colorado
   Boulder, CO
   80309-0390 USA
   scott.robertson@colorado.edu
   (b) 303 492 5565
   (c) 303 492 0642
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3. (a)
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