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Determination of impact position on an impact ionization detector by electrostatic induction

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Abstract

The application of impact ionization for the measurement of micrometeoroids in space are a sensitive and established method for particles in the size range between a few nanometer and a few micrometer. For the measurement of micrometeoroid trajectories, the knowledge of the velocity vector and the related impact position is required. A typical impact ionization detector employs a hemispherically shaped conductive metal target, and a hemispherical grid electrode. The impact charge is dependent on the particle mass, particle speed and incident angle. For a collimated particle flux which is parallel to the symmetry axis, the impact direction and its related impact angle relative to the target normal varies with the radial distance from the symmetry axis. It is therefore essential to consider the impact position during calibration of impact ionization detectors. Furthermore, the induced charge signal shape varies with impact position. We perform simulations with the Coulomb software package and we do compare the results with experimental data. An empirical formula is derived to determine the impact location of the particle from the target and grid induction signals.

Keywords:

dust, instrumentation, impact ionization detector, charge induction

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