

Properties of meteoroids observed by the Earth-orbiting Cluster spacecraft

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Abstract

Most of the Earth-orbiting satellites do not have conventional dust detectors. When a micrometeoroid hits a spacecraft, it induces an expanding plasma cloud, which can be recorded by electric field probes as brief, high amplitude voltage spikes. A systematic search has shown that the Cluster Wide-Band Data (WBD) instrument can monitor hypervelocity impacts. There are though many issues that must be taken into account when analysing the observed events. The Cluster 1 satellite operates since 2009 in a monopole mode after several antenna failures. This benefits meteoroid observations since monopole detectors are much more sensitive to dust impacts than dipole antennas. The automatic gain control applied by the WBD instrument adjusts the dynamic range of the recorded signals. The impact signals can be affected both by saturation or be too weak for analysis depending on which gain level was active on the instrument when they occurred. Even natural waves can confuse the observations. Since Cluster is a magnetospheric mission, the instruments are not recording data throughout the whole orbit. A review will be given showing some events observed with Cluster so far, what properties of the meteoroids can be resolved, what are the benefits and limitations of the method in respect to Cluster and what can be expected to be found in the further dust impact search.