

Development of the Experimental Set-up for Lunar Dust Particles Investigation and Instruments calibrations

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Abstract

Introduction:

The complex of scientific instruments of the Lander "Luna-Glob" included device PML. This instrument is designed to study the dust component, its dynamics in the near-surface exosphere of the moon, the registration of micro-meteorites and secondary particles of the lunar regolith, impact by micrometeorites and the measurement of their physical characteristics. The device directly measured momentum, velocity, mass and charge of the particles.

For the purpose of conducting physical experiments on modeling of the dusty environment conditions in the surface layer was created an experimental setup. This unit is designed for carrying out functional tests, adjustments and calibrations of the instrument. The installation is carried out testing of the methodology of space experiment. It is planned to hold correction of the coefficients of relative sensitivity and verification of the scientific data obtained during the mission.

Experimental set-up:

The experimental set-up is realized on the base of the vacuum chamber and includes a system of supply and control of vacuum, the injector (generator) of charged particles. The setup includes the control system for measuring the speed of the charge of particles and the system to measuring and control electrical signals and instrument parameters. Vacuum system provides vacuum with a residual pressure sufficient to operate the injector of the dust particles and simulate the conditions of the dust of the atmosphere. Injector (generator) of dust, charged particles produces a stream of metallic, charged particles with dimensions from units to hundreds of microns with flow rates from units to tens of meters per second with a charge of not less than 1000 electrons per the particle. The measuring system for the control of the speed and charge of particles

consists of the induction sensor and charge sensitive amplifiers that allow to display and measure the signal. Method of measuring charge is based on the measurement of the induced mirror charge from the moving particles in the metallic electrode of the induction sensor. The geometry data of the placement of the induction sensors is used to measure the speed of particles by time delays of signals.

The voltage applied to the injector governs the speed and charge of the injected particles. In the experiments are used different in size and mass of particles loaded into the injector.

Since the process of injection and the detection of particles are random, the statistical methods to handle the large volume of accumulated data are used.

Results:

The set-up made it possible to realize the streams of charged particles with velocities in the range of 2 to 60 m/sec for the metalized particles with sizes from 10 μm to 200 μm .

On the installation was carried out calibration of the engineering sample PML device, had allowed to determine the sensitivity of the sensors of the device. Threshold sensitivity for the charge is amounted to 2 000 the charge of the electron. The threshold sensitivity of the momentum is amounted to the value of $3 \cdot 10^{-12}$ Newton*sec.

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