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DEVELOPMENT OF A SYSTEM OF MULTIPLE SMALL SATELLITES FOR SPACE RADIATION MONITORING

Abstract

The fluxes of energetic particles near the Earth pose a significant radiation threat to spacecraft electronic. At the same time the fluxes of particles in Earth's radiation belts even during geomagnetically quiet conditions experience mid- and long-term variations within several orders of magnitude. Therefore using the existing static empirical models of Earth's radiation belts to estimate radiation conditions in spacecraft orbits is not always appropriate.

For that reason Skobeltsyn Institute of Nuclear Physics of Moscow State University (SINP MSU) is developing a system of small spacecraft for operative (close to "real time") monitoring of radiation conditions in the near-Earth's space.

Several small spacecraft with a mass of <50–100 kg should be launched to different circular orbits or a specifically selected elliptical orbit, crossing the wide range of magnetic drift shells at different altitudes;

measure fluxes of energetic electrons and protons by multidirectional detectors; and promptly transmit the data of measurements to the ground using satellite retranslation systems. In the ground data-center on the basis of these data the distribution of particle fluxes in the whole Earth's radiation belts (up to GEO) will be computed. Finally the end-user will be able to access the data center by the web and find out current radiation conditions in the near-Earth's space or in a particular orbit.

Other applications of received experimental data will be: developing the new (possibly dynamical) Earth's radiation belt models, and studying the problems of Earth's magnetosphere physics.

For placing satellites into orbit it is planned to take advantage of accompanied launch by "Soyuz" rocket with "Frigate" upper stage developed by NPO Lavochkin, for example during launch of main payload into "Molniya"-type orbit. Alternatives are using the light-class space rocket or rising from LEO by using compact electric rocket engine.

Currently the first research stage of this project is being carried out under the contract with Ministry of Education and Science of Russia, during which the optimal spacecraft orbits and detector construction and placement are being determined.