the object irradiated by the laser and electron, ion and neutral particle beams;

— modeling the collisions of space objects moving at hypersonic velocities by means of charge-particle beams;

— identification of space objects using regular and stochastic radiation produced by a plasma-beam EHF-generator.

The on-board experimental unit will include the electron accelerator generating beams with electron energies E_b = 1 MeV, electron current I_b = 25 kA, and pulse duration τ = 15 ns. The beams will have the following main parameters: beam cross-section S_b = 1 cm^2; beam power $P_b = 25 \cdot 10^9$ W; beam energy per impulse W_b = 375 J. The efficiency of the electron accelerator is η = 50 %. The total energy, which is necessary for producing 10 pulses, is W_s = 7.5 KJ.

We suggest that a plasma channel can be used for transfer of a powerful relativistic beam to the object. This plasma channel will be immediately created by the electron beam during its propagation in the gaseous medium. We propose using a metallic tube to provide the optimal current and charge compensation. It should be filled by gas with the pressure of 1-2 Torr and should have the diameter larger than the beam diameter. Such conditions of the experiment will also prevent charge accumulation in the spacecraft, where the electron accelerator is situated. If this tube is made of duraliminium, the application of the electron beam under the above conditions will provide the needed pulse of J = = 0.06 N·s. The above parameters allow achieving the most efficient energy conversion of the electron beam into vapours which ensures the maximal recoil momentum.

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«Approach» Experiment

APPROACH OF SPACE DEBRIS TO THE ORBITAL SPACECRAFT

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Dangerous approach of space debris to the «Mir» OSS and catastrophic damage to the French «Ceriese» spacecraft (1996), give evidence of practical necessity of prediction of such phenomena, especially in the cases of manned missions and nuclear sources presence onboard the spacecraft. Radar observations permit prediction of only the dangerous approaches (< 3 km) of large space debris (> 10 cm). However, collisions with centimeter-sized objects can also have a disastrous effect, taking into account their multiplicity and velocity. Ground-based registration of these objects

using optical electronics is possible, but creation of a database (similar to that existing for the large space objects) suitable for accurate prediction of their motion, is considered to be unrealistic. These data can be used only for statistical models, which describe the motion of a group of bodies as a Poisson's random process, and give results, which are too rough to be used for estimation of the hazard of collision of individual objects.

Analysis of models leads to the conclusion that the strict deterministic models cannot be supported by the input experimental data, but on the other hand the available statistical data do not provide acceptable estimates of the risk of approach. In addition to these two classical models of motion of the orbital objects, there are the so-called «semi-deterministic» models, which allow obtaining the same parameters as those derived from the deterministic models. The distribution of the minimal distances between the approaching objects is one of such parameters. This characteristic is regarded to be the main index of space debris population. Obviously, if a means were provided for measuring this index, the hazard of collisions between space debris and operating satellites could be predicted more precisely.

The main goal of the experiment is to develop a technique for experimental research of orbital object characteristics, which evaluates the risk of operating spacecraft being damaged by space debris. An important feature of the experiment is to obtain not only the spatial distribution of the objects around a spacecraft orbit but also the distribution of minimal distances to these objects during their approach to the ISS.

Small space objects move in clusters formed by explosions and destruction. Ground tracking station control gives evidence that some orbital parameters of the objects forming the cluster are highly localized. These data are related to the catalogued objects (> 10 cm), but the degree of localization of small-sized (several centimeters in size) objects can be also assessed, when the available models of explosion and destruction, as well as of evaluation of debris orbits are applied. Our approach is based on a priori data on localization of orbital characteristics of space objects. Knowing the region of space debris parameter localization, it is possible to determine a set of angles of approach of the objects to the spacecraft and their relative velocities. The relative velocities obtained permit the distance to the objects to be estimated using just the results of positional measurements.

The experimental complex will consist of a wide-angle optical system (telescope) equipped with a CCD camera to detect object images and with instruments to process the coordinate measurement results. The control system software will provide orientation of this system, taking into account the dependence of the direction of an object approach on time.

The proposed experimental complex will enable all the dangerous objects in the vicinity of a 5-km zone of the ISS to be recorded.

«Lightning» Experiment

DIAGNOSTICS OF ACTIVE EXPERIMENT DISTURBANCES IN THE NEAR-EARTH SPACE

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At present active experiments which affect the space environment through powerful radio emissions, charge carrier injection, chemical agent ejection and some side effects accompanying launches and flights of the space rockets, industrial explosions, on-board technological operations are the main methods for studying the physical processes in near-Earth space. These methods allow simulation and triggering of the natural phenomena, which occur during various geophysical disturbances and plasma diagnostics.

The goal of the experiment is to develop on-board active experiment procedures and carry out monitoring of the disturbances initiated by these experiments. It will allow simulation and study of mecha-