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Experiment to search for heliogeophysical phenomena in cosmic rays in Earth orbit

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The “Nadya” compact precision spectrometer, currently under development at MEPhI (National Research Nuclear University), is designed to detect and identify directional charged-particle fluxes in the energy range from several tens to several hundred MeV. This energy range is of interest for the search for and detailed study of heliogeophysical phenomena, Earth’s magnetospheric physics, radiation belt dynamics, and the spatiotemporal variations of the low-energy component of galactic cosmic rays (GCRs) in high-latitude regions. The experiment’s scientific program focuses particularly on the continuous monitoring of solar cosmic rays (SCRs) and the investigation of the mechanisms governing their generation, acceleration, and propagation in the interplanetary medium during periods of heightened solar activity. The data obtained will be vital for real-time space weather monitoring, modeling the radiation environment in near-Earth space, and assessing radiation loads on spacecraft onboard electronics; these data will complement findings from previous experiments—including precision missions like PAMELA, for which this specific energy range was inaccessible. The “Nadya” instrument is scheduled for launch aboard the A-100 unified spacecraft platform (developed by the company L5) into a circular sun-synchronous orbit with a mean altitude of 450–650 km and an inclination of approximately 98°. This orbital configuration ensures regular passes over polar regions characterized by low geomagnetic cutoff thresholds, as well as through the South Atlantic Anomaly—conditions essential for a comprehensive analysis of particle flux anisotropy across various helio-geophysical environments. The spacecraft launch is planned for the first half of 2027. The key performance characteristics of the scientific instrumentation have been optimized to meet the strict resource constraints of small satellite platforms: the total instrument mass is approximately 3 kg, and the average power consumption during standard measurement operations does not exceed 15 W. The projected volume of scientific telemetry data transmitted to the ground control segment reaches 10 GB per day, ensuring high statistical significance for the recorded events.

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