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SLAVIA (SPACE LABORATORY FOR ADVANCED VARIABLE INSTRUMENTS AND APPLICATIONS) AS A LOW-COST ASTEROID PROSPECTION MISSION.

Abstract

The idea of SLAVIA (Space Laboratory for Advanced Variable Instruments and Applications) project is a tandem mission of two 16U CubeSats, each equipped with three novel advanced scientific payloads: multispectral camera VESNA intended for spectral elemental analysis and video observation of meteors, HANKA mass spectrometer exploring the elemental and molecular composition of interplanetary dust and radio instrument Říp-2 designed for recording radio signal emitted or reflected by meteor plasma. SLAVIA will demonstrate in Earth orbit a concept and technology of low-cost satellite mission providing systematic spectral analysis of NEO space resources.

A tandem of SLAVIA satellites is expected to be launched in 2026 to the SSO 600km orbit. The planned duration of the mission is 2 years. Meteor spectrograph VESNA will observe night side of Earth under tilt angle of 27 degrees with overlapping FOV in spectral range of 200 – 700 nm with resolution better than 0.5 nm. Two very similar satellites will fly in the “relaxed” formation of around 1000 km distance between the spacecraft with allowable tolerances of [+150 km, -250 km]. Such a strategy allows not only to record spectra of meteor plasma in wide spectral range and calculate bulk elemental composition of particular meteoroid, but also to compute its trajectory in the Solar system based on stereoscopic data. Říp-2 antenna system will provide detailed insight in meteor plasma parameters. This allows us to perform very detailed fit of elemental composition with particular interest towards detection of Ti, Cr, Mn and other industrial elements. Advanced orbitrap-based mass spectrometer HANKA will provide with unprecedented resolution (of 50 000) on-line detection of minor elements such as Rh, Pt, Pd or water in corresponding dust particles in direction of major interplanetary dust sources – Apex, Helion, Antihelion, Southern and Northern Toroid.

SLAVIA will demonstrate for the first time a series of novel technologies suitable in future for asteroid or Moon space resources mapping using advanced spectral techniques. The mission will also pave the way to development of future missions using similar techniques for exploring the Apophis in situ in 2029, and later on, on the Moon in the 2030s. The long-term goal is creating an evidence-based map of resource wealth and unlocking the possibility of reasonable space mining.