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# SLP: THE SWEEPING LANGMUIR PROBE INSTRUMENT TO MONITOR THE UPPER IONOSPHERE ON BOARD THE PICASSO NANO-SATELLITE

**Abstract**

The flourishing development of small/micro/nano platforms could offer the opportunity to decrease significantly the cost of science missions if suitable instruments can be operated from such platforms. Langmuir probe instruments have been used for decades on board large/medium-size satellites to measure ambient plasma properties (electron density and temperature together with ion density) but their operation on board smaller platforms raises several issues in addition to miniaturisation and drastic reduction of power consumption. The limited conducting area of the spacecraft will imply spacecraft charging and drift of the instrument's electrical ground during the measurements, which would lead to unusable data. Furthermore, given the limited dimensions of the spacecraft and thus the small dimensions of the probes and booms, some hypotheses required to apply traditional Langmuir probe theory to retrieve the plasma parameters are not fulfilled. Finally, the usually limited telemetry bandwidth available on nano- to small satellites requires the use of untraditional measurement and data processing approaches.

The Sweeping Langmuir Probe (SLP) instrument, that uses a novel measurement technique, has been developed at the Royal Belgian Institute for Space Aeronomy to overcome the above mentioned issues. SLP will fly on board the ESA scientific in-orbit demonstrator PICASSO together with the hyper-spectral imager VISION. PICASSO, a triple unit CubeSat of dimensions 340.5x100x100 mm, will be launched in summer 2019. The goal of the mission is to prove the feasibility of performing true science (with limited extent) with a nano-satellite and demonstrate the very low cost / science ratio with respect to big missions. SLP will allow a global monitoring of the ionosphere with a maximum spatial resolution of the order of 150 m. The main goals are to study the ionosphere-plasmasphere coupling, the subauroral ionosphere and corresponding magnetospheric features together with auroral structures and polar caps, by combining SLP data with other complementary data sources (space- or ground-based instruments). SLP can measure plasma density from 1e8/m3 up to 1e13/m3 and electron temperature between 1000 K and 15 000 K.

The results from the measurements performed in a plasma chamber prove the suitability of SLP to be used as a true scientific instrument on a CubeSat. Given its capabilities, miniaturisation, low power

consumption and already high TRL, SLP can be easily accommodated in any (2U Cubesat or larger) satellite either as a plasma diagnostic instrument or as an accurate spacecraft potential monitor.