



Innovative ground motion sensors for planets and asteroids: PIONEERS H2020-SPACE european project

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Planetary seismology is a key technique to image the internal structure of planetary objects. It targets fundamental science objectives from the formation of planetary systems to the characterization of habitable worlds.

PIONEERS is a H2020 granted project starting from Janvier 2019. It is aimed at entering a new realm of planetary exploration with an innovative ground motion instrumentation concept relying on high precision sensors based on optical interferometry, and on 6 degrees of freedom (6 DoF, with 3 translations and 3 rotations) measurements. It will provide substantially more precise science return compared to usual seismometers. Only recently emerging for terrestrial applications, 6 DoF measurements target fundamental planetary science objectives, from the formation of planetary systems to the characterization of habitable worlds, supporting also planetary defense and asteroid resources applications.

The PIONEERS project will develop two 6 DoF instruments for measuring ground deformations of planetary objects. The first instrument is a very low noise 6-DoF engineering model dedicated to imaging the internal structure of terrestrial planets. The second one is a high TRL, reduced scale version of the same instrument dedicated to the exploration of small bodies, in order to support planetary defense and asteroid resources applications.

Instruments will be designed based on scientific requirements, and re-using planetary seismology expertise and space qualified, high performance optical technologies provided by the PIONEERS partners. The science case of 6 DoF planetary exploration will be demonstrated through simulations, application of innovative data analysis methods, and testing in Earth analogue and laboratory environments.

An improvement of instrument noise of two orders of magnitude is expected for the planetary prototype by using optical sensing technologies. Cost optimization and adaptation to CubeSat standards will drive other technological developments that will open new markets for high precision scientific instrumentation.

The PIONEER project initial specification and performance analysis will be presented.