H2020 PIONEERS Study: Planetary Instruments based on Optical technologies for an iNnovative European Exploration Using Rotational Seismology.

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Planetary seismology is a key technique to image the internal structure of planetary objects and target fundamental science objectives from the formation of planetary systems to the characterization of habitable worlds. With the SEIS instrument on board InSight mission, Europe has demonstrated its leadership in developing such instrumentation.

The H2020 PIONEERS study has been selected by EU last summer to build the future of the geophysical exploration of telluric planets : building on the heritage of the SEIS/InSight seismometer, it aims helping Europe to keep its technological advance in planetary seismology with the development of an innovative 6 Degree of Freedom ground motion instrument concept, based on optical interferometry. The proposed instrumentation will enclose 3 translation measurements based on linear actuators (the new generation of Very Broad Band Seismometers) and 3-rotation measurements based on Fiber Optics technology that provide substantially more science return compared to usual seismometers.

The PIONEERS project is currently developing two 6 DoF instruments. The first instrument is a very low noise 6-DoF engineering model dedicated to imaging the internal structure of terrestrial planets and moons. 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. The latter is currently considered to be part of the MMX rover, a technological demonstration led by CNES and DLR, on board the MMX mission led by JAXA.

We build the instruments with the expertise in planetary seismology and high-performance optical technologies provided by the PIONEERS partners. Innovative data analysis methods, as well as Earth analogue field testing will validate the expected increase of performance levels by two orders of magnitude for the planetary instrument. Cost optimization, ITAR-free strategy and adaptation to CubeSat standards will drive other technological developments opening new markets for high precision scientific instrumentation.

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