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A COMPACT SEISMOMETER FOR THE GEOPHYSICAL EXPLORATION OF SMALL BODIES

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ABSTRACT

Over the last century seismology has revolutionised our understanding of our planet, of the Moon, and of Mars. However, despite the fact that the power of seismology for geophysical exploration has been clearly demonstrated, seismic measurements have never been made on the surface of an asteroid.

Natural seismic sources, such as micro-meteoroid impacts, thermal cracking and tidal quakes, are expected to occur on asteroids. Such sources could excite seismic waves and allow the asteroid's internal structure to be imaged with a seismometer. In the framework of the NEO-MAPP European Commission Horizon 2020 project, we are developing a low mass, low power seismometer that can fit inside a small asteroid lander (e.g. a CubeSat) and function in the challenging environment of the asteroid surface.

The seismometer consists of three sensors (geophones) that will each measure the ground motion along one axis. The seismic sensors are commercial sensors with no active electronics that have been specifically designed for borehole extreme environments. The robustness of the sensors has been demonstrated during initial environment testing (vacuum, vibration) using the facilities at ISAE-SUPAERO. The instrument analogue and digital electronics are also being developed at ISAE-SUPAERO.

In this presentation we will discuss the expected signal characteristics from the natural seismic sources on asteroids before presenting the compact seismometer specifically designed for small body exploration. The instrument design, development status and expected performance will be presented.

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