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Lunar Optical Very Broad Band Seimometer

Sébastien DE RAUCOURT[1#+], Gabrielle CHABAUD[1], Raphael GARCIA[2], Frédéric GUATTARI[3], Frans IJPELAAN[4], Taichi KAWAMURA[1], Philippe LOGNONNÉ[1], Tanguy NEBUT[1], Gabriel PONT[4], Olivier ROBERT[1], Carla SANNA[5], Sylvain TILLIER[1]
[1]*Université Paris Cité, France*, [2]*Institut Supérieur de l'Aéronautique et de l'Espace, France*, [3]*MAÅGM, France*, [4]*National Centre for Space Studies, France*, [5]*Exail, France*

The Apollo seismic experiment provided unique Moon seismology data, however understanding and knowledge on the Moon interior structure is limited its performances. 50 years later, the Mars seismometer Insight/SEIS demonstrated lower self-noise and better resolution. A spare model will be sent to the Moon in 2026 with the FSS (CLPS 12) mission. However, it is far from meeting the International Lunar Network (ILN) requirements. To meet those requirements, technological breakthrough is needed. By switching from electrostatic displacement sensors to interferometer, an improvement of several orders of magnitude is made on parasitic force (electrostatic noise to pressure radiation). The Lunar Optical Very Broad Band Seismometer is made of two subsystems: a mechanical oscillator and a displacement sensor. The mechanical oscillator is guided by a four blades hinge and equilibrate by a leaf-spring. It has a heavy proof mass (1Kg) and a low normal frequency (0.22Hz) to ensure low suspension noise. A locking device will hold the mobile part during launch and landing. The displacement sensor is based on a Michelson interferometer implemented on the sensors head and a laser source and optical readout electronic deported at the end of a single optical fiber. With this design, we have a very robust and simple sensor head that withstand high temperature range (-80°C to + 60°C) and a high performances electronic remaining in the warm enclosure of the lander. The tether in between is simple with only 2 copper wire and an optical fiber per axes. To minimize risk, the design benefits from high heritage. The mechanical oscillator uses the same technology – but different geometry for the pivot and spring. The optical readout technology is inherited from Fiber Optics Gyroscopes widely use in space. Prototype is under integration. This instrument will be candidate for all flight opportunities around 2030 (launch date).