

## Toward an international Earth-Moon network for joint seismic and impact flash monitoring of the Lunar impacts

*International workshop, Paris, France, November 5-7, Université Paris Cité, Institut de physique du globe de Paris, CNRS, Amphithéâtre Pierre-Gilles de Gennes, Bâtiment Condorcet, 4 Rue Elsa Morante, 75013 Paris*

### Second announcement

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Three seismic experiments will operate soon on the Moon, more than 55 years after the deployment of the first Apollo seismometers. The first will be the **Lunar Seismograph (LS)** onboard the CSA mission ChangE'7, scheduled for launch in August 2026. The next two will be the **FarSide Seismic Suite (FSS)** experiment and the **Lunar Environmental Monitoring Station (LEMS)**, respectively, onboard a lander from NASA's Commercial Lunar Payload Service and onboard the NASA Artemis III mission. Both are scheduled for a launch during the second half of 2027. LS will be deployed on the Shackleton crater rim by CE7 near the lunar South Pole, FSS will be placed in the Schrodinger Basin on the lunar far side, and LEMS will land near the lunar South Pole. Together and despite their instrumental and programmatic differences, these three stations will establish the first lunar seismic network since the Apollo seismic stations. They will monitor deep moonquakes, as those already detected and located by Apollo, as well as meteoroid impacts, the second source of seismicity of the Moon.

As demonstrated during Apollo, impacts will not always be detected by the three future seismic stations, even when they are operating simultaneously. Furthermore, their location and impact time must be determined in order to use the recorded seismic signals to extract information on the lunar structure, including lateral variations in crust and upper mantle. But, as shown over the past 25 years, meteoroid impacts on the surface of the moon produce light flashes (Lunar Impact Flashes, or LIFs) that can be located and timed from Earth-based telescopic observations in visible light, when the Moon's non-illuminated side is observable at night. Looking ahead, new initiatives aim to extend and enhance this capability: ERC-funded Advanced Grant **LISTEN-Flash** will conduct earth-based monitoring of the lunar near side in the infrared, while ESA's **LUMIO** mission (launch in 2027) will deploy a nanosatellite to monitor LIFs on the farside. Finally, once LIFs provide an approximate location, the newly formed craters can be confirmed and studied through differential imaging of high-resolution lunar orbital imagery.

Hence, starting in 2026, the LS, FSS and LEMS lunar seismic stations, complemented by Earth-based telescopes operating in visible and infrared, ESA's space-based LUMIO mission, and high-resolution lunar orbital imagers, will revolutionize impact science through **multi-messenger observations** that combine seismic signals, optical flashes, and post-impact crater imaging. This integrated approach will not only advance our knowledge of the seismic and geological structure of the lunar crust and upper mantle, but will also provide stronger constraints on the impact flux in the Earth-Moon system—crucial both for assessing impact-related hazards and for improving our understanding of crater formation and shock-wave processes.

The goal of this workshop will be:

- To bring together the communities of LIFs observers, planetary seismologists of the FSS, LS and LEMS teams and planetary geologists searching for lunar fresh impacts in high-resolution imaging systems.
- To present the most recent science analysis on both lunar seismology, LIFs and fresh crater observations, with a focus on impact processes
- To demonstrate the needs for LIFs observations
- To enable future collaboration when data flows from seismic stations of different agencies operating on the Moon, likely in 2027 and later.
- To bring awareness to national agencies of the international character of joint LIFs-Seismic observations by an Earth-Moon network.

The workshop will be 2.5 days long, starting on Wednesday, November 5<sup>th</sup>, 13:30 and ending on Friday, November 7<sup>th</sup>, 18:30. It will be held in the Univ. Paris Cité, with sponsorship from the European Research Council (ERC LISTEN FLASH), Univ. Paris Cité, Institut de physique du globe de Paris (IPGP), the Centre national d'Etudes Spatiales (CNES) and the Centre National de la recherche Scientifique (CNRS). The program will include in person presentations on the LS, FSS, LEMS and LT-FLASH missions and projects made by the respective PI or co-PIs.

The workshop will evolve around a single plenary session (oral presentations of 15 minutes, including questions and transition) and with an additional poster session. In-person participation is strongly encouraged, and remote participation will be restricted to those selected for oral presentation. There is no registration fee for the workshop. A social event will be organized on Thursday, November 6<sup>th</sup>, with a participation fee and registration by October 15<sup>th</sup>.

Registration must be done (50-person limit) via this link by October 6<sup>st</sup> : <https://forms.gle/A3FvyxyyQaDRZYyQ8>

Upload Abstract (title, author name list with presenting author affiliation and email, one page maximum, with oral/poster preference) by October 6<sup>st</sup> here: <https://www.dropbox.com/request/DiDXNtC408sfm49wlfh7>.