

## Development of optical seismometers for observations at extreme environments

ARAYA, Akito<sup>1\*</sup>, HORI, Teruhito<sup>1</sup>, NISHIKAWA, yasuihiro<sup>1</sup>, KOBAYASHI, Naoki<sup>2</sup>, SHIRAISHI, Hiroaki<sup>2</sup>, KAKUMA, Hideaki<sup>3</sup>, ISHIHARA, Yoshiaki<sup>4</sup>

<sup>1</sup>ERI, Univ. Tokyo, <sup>2</sup>ISAS, JAXA, <sup>3</sup>ADEP, <sup>4</sup>NAO, RISE

Seismic observation is useful for investigating interior structure of the Moon and planets. Especially for global structure including deep structure, broadband seismic observation is required. Although short-period seismometers have been used for seismic surveys in the Moon and Mars, broadband seismometers on the surface environment would open up new interior information. Similarly on the earth, broadband seismometers in the deep borehole enable us to observe near a seismic region at low background-noise environment. Hence, broadband seismometers for extreme environment in temperature, cosmic rays, limited power/space, and impact by launch/installation would be essentially required for future seismic surveys. For this purpose, we have been developing optical seismometers that can be used at extreme environment; a laser interferometer, which can operate in such environment, senses pendulum motion with high sensitivity.

We developed a prototype (dimension: W200mm H210mm D115mm) and have confirmed its stable operation, broadband performance (1mHz-50Hz), and self noise level. Optical fibers are used to transmit laser light. In parallel, we have carried out a high-temperature test for the laser interferometer, and confirmed normal operation up to 290 degrees centigrade.

Currently, we have started making a smaller model and developing an automatic operation system. Because optical sensors can be operated in various environments with flexible configuration, they are also useful for planetary explorations on Venus, Mercury, icy satellites of outer planets at extreme temperatures.

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