

Design and Evaluation of an Optical Interferometric Seismometer for the Construction of a Lunar Seismic Observation Network

*Akito Araya¹, Keisuke Onodera¹, Taichi Kawamura², Takeshi Tsuji³, Satoshi Tanaka⁴

1. Earthquake Research Institute, University of Tokyo, 2. Institut de Physique du Globe de Paris, 3. Department of Systems Innovation, University of Tokyo, 4. Institute of Space and Astronautical Science, Japan Aerospace Exploration Agency

In recent years, international space exploration targeting the Moon has been considered, and the construction of a seismic observation network on the Moon is one of them. In the 1970s, the Apollo program deployed a seismic observation network on the lunar surface, which revealed some aspects of lunar seismic activity and internal structure. If we can construct an observation network with a number of seismometers distributed all over the Moon using modern technology, we can observe the three-dimensional structure of the lunar interior and the details of the interior activity, which will help us to understand the origin and evolution of the Moon. In addition, detailed exploration of shallow subsurface structure will provide fundamental data on the ground for future human activities and construction on the Moon.

This study is aiming for developing a seismometer for deploying a seismic network on the lunar surface. Optical interferometry has excellent displacement detectability and environmental tolerance, which are suitable characteristics as a displacement sensor of a seismometer deployed on the Moon's surface. It is necessary to deploy high-performance seismometers on the Moon that can be used for long-term observation over a wide temperature range, including capability of lunar night survival. The optical measurement method, in which the light source can be branched and distributed by optical fibers, has some advantages in that it is easy to deploy multiple seismometers. In this presentation, design and performance of the optical interferometric seismometer for the use of the lunar seismic observation network will be shown.

Keywords: Lunar Seismic Observation Network, Laser, Interferometer, Seismometer