可搬型重力勾配計のためのデータ収集系の開発
Development of a data acquisition system for a portable laser-interferometric gravity gradiometerDevelopment of a data acquisition system for a portable laser-interferometric gravity gradiometer

*彦坂 太一[1]、潮見 幸江[1]、渡邉 駿介[1]、松田 耀旬[1]、山本 竜典[1]、薛 凱倫[1]、山田 功[1]
*Taichi Hikosaka[1], Sachie Shiomi[1], Shunsuke Watanabe[1], Yoshun Matsuda[1], Tatsunori Yamamoto[1], Kailun Xue[1], Kou Yamada[1]

1. 国立大学法人　群馬大学
1. national univercity corporation Gunma university

A gravity gradiometer is an instrument to measure gravity gradients caused by local density variations. Gravity gradiometers can be used for surveys of soil moisture and exploration of underground resources. We are developing a portable gravity gradiometer, which is suitable for field measurements. In our gravity gradiometer, a pair of test masses set at different heights (separated by about 70 cm) in a vacuum tank is tossed up at the same time. The vertical gravity gradients are obtained by measuring differential acceleration between the test masses that are in free fall, using a Michelson interferometer.

The first prototype of the gravity gradiometer [1] was fabricated and operated at the Sakurajima Volcanological Observatory of Kyoto University. In spite of the high seismic vibration at the observatory, the resolution of the prototype was ±0.3 μGal/m, which is the same level as that operated at a quiet site. However, the prototype is heavy (weighs about 200 kg) and a crane lorry was necessary for the installation. We are developing a less heavy gravity gradiometer, which is easy to install and operate at local observatories.

A new gravity gradiometer was built up in 2016. This gravity gradiometer weighs less than a half of the first prototype (about 80 kg) and its toss-up mechanism was improved for a better precision. Its performance was tested by using an optical lever. The results showed that the rotational acceleration disturbance of a tossed-up test mass was less than 0.01 μGal [2]. In this study, we have developed a data acquisition system and carried out further evaluation of the toss-up mechanism by changing the time interval of measurements. I will report the results of the evaluation.

References

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