

## **S.M. Svitlov. Research report for ERI visit 06.10.2016-20.11.2016**

This short-term visit is a continuation of our collaboration with Prof. Akito Araya in the field of absolute gravimetry. Specifically, our efforts are focused on development and improvements of compact absolute gravimeters for advanced observations of volcanic activities.

As it is known, gravity variations can be associated with underground mass distribution; therefore, absolute gravimeters are particularly useful for monitoring gravity changes due to magma motion without the need for any gravity reference points. In such instruments, the displacement of a freely falling object is monitored using a laser interferometer and highly precise length and time standards. To obtain meaningful gravity changes caused by the magma motion, a few absolute gravimeters need to be installed at several points above the varying gravitational source around the center of the volcano. The instruments should be tolerable to external vibrations, and for the same time they should be made compact and mobile for such observations. During this visit, our task was evaluation of systematic errors of the free-fall TAG-1 and rise-and-fall TAG-2 absolute gravimeters, prototyped at ERI.

For the TAG-1, we continued metrological characterization of the prototype through investigation of several specific systematic errors: non-linear phase-shifts in electronics and limitations of the built-in vibration compensation system. For better interpretation of our findings, we conducted additional experiments at the 'Esashi' absolute gravity station, which are still under processing and analysis. The TAG-1 absolute gravimeter participated recently in a local comparison with five other absolute gravimeters; so far, we expect to verify and reduce its systematic error down to 10  $\mu\text{Gal}$ .

For the TAG-2, we analyzed an initial systematic offset of order 400  $\mu\text{Gal}$  and made great advance in data analysis, optimization of processing algorithm and interpretation of possible perturbations that resulted in reducing the systematic error down to about 50  $\mu\text{Gal}$ .

As a part of the visiting program, I gave a talk titled 'Laser interferometry in absolute gravimeters: signal processing and error analysis' on the ERI scientific seminar.

We expect that the conducted research will advance development of geophysical instrumentation, which might facilitate observations and confident measurements in the areas with the restricted access, such as volcanic areas.

It is my pleasure to say thanks to Prof. Akito Araya for giving such challenging scientific tasks, guidance and fruitful discussions, to Ms. Yuko Yamada for her support during preparation and on every consequent step of my visit, and to Mr. Hirotaka Sakai for his attention during our experiments and data analyses and also for kind introducing me exciting off-hours life in Tokyo.