様式 2 (Form 2)

（2015 年 1 月改定）

滞在型研究員報告書
Activity Report for the NAOJ Visiting Fellows Program

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氏　　名 (Name)	Ekaterina Kronrod
研究課題名 (Research subject)	Multidisciplinary lunar internal structure modeling
滞在期間 (Period of stay)	年　月　日～　年　月　日 2015　06　11　2015　07　10
受入責任者氏名 (NAOJ host researcher)	Prof. Koji Matsumoto

１．滞在型研究員として国立天文台滞在中に行った活動について簡単にお書きください。
(Summarize your activities during the stay using the NAOJ Visiting Fellows Program.)

I. The first part of participating in the NAOJ Visiting Fellows Program was getting acquainted with theoretical basics and programs developed by Japanese scientists in RISE Project Office NAOJ for lunar internal structure research. They are the following:

1. The basics of geodetic concepts. The explanation of elements of potential theory (Gravity potential, Laplace's equation, spherical harmonics) and the theoretical base of calculation of the second degree Love number k2, h2 and l2 was provided by Prof. Matsumoto.

2. Program of calculation of the real part and the imaginary part of Love numbers k2 and h2 for the profile with specified parameters μ, kappa and ρ with depth (by K. Matsumoto) on the base of program of Love number calculation (written by S. Kamata).

3. The theory and method of travel time of seismic wave calculation and the structure of program of travel time calculation (written by R. Yamada) was provided by Dr. Yamada.

4. The theory of a Bayesian inversion approach and Markov chain Monte Carlo (MCMC) algorithm to infer the parameters of the lunar internal structure and Program of calculation of likelyhood function (LHF) for a specified model.

II. The second part was about the thermodynamic approach to the study of the internal structure of the Moon, which is used by Russian scientists, and programs developed in the laboratory of thermodynamics and mathematical modeling, Vernadsky Institute of Geochemistry and Analytical Chemistry , Moscow (the head of laboratory – Kuskov O.L.):

1. A talk “Thermodynamic approach in the planetary bodies internal structure study” was given at the seminar.

2. The explanation of the principle of the thermodynamic approach and program of seismic velocities and density calculation at the satisfied temperature and depth for the five-component system (CaO-FeO-MgO-Al_2O_3-SiO_2) using a method of minimization of the total Gibbs free energy combined with a Mie-Grüneisen equation of state and self-consistent thermodynamic data for minerals and solid solutions was given for Japanese scientists Prof. Matsumoto and Dr. Yamada.

III. Plan of the further investigations:

We have discussed possibilities of further collaboration: how to include Russian program of thermodynamic parameters calculation into Japanese program on inverse problem solution.

２．今回滞在型研究員として得られた成果について簡単にお書きください。
(Summarize your research products from the stay.)

During my stay at the NAOJ observatory as a result the program code for the calculation of the thermodynamic parameters was compiled in the same system as the Japanese programs.
The task of further research is to understand how to include thermodynamic calculations in the program to address the full inverse problem.

３．この制度について何か御意見がありましたら、お書きください。
(Please provide any comments about this program.)

This program made it possible to start joint research in the study of the internal structure of the Moon. Combining different research methods allow us to constrain more accurate model of the internal structure and composition of the Moon.
Further joint investigations to obtain significant results require more time and efforts from both Russian and Japanese sides.