STEPS Students Report

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Moscow State University, I study under the supervision of Prof. Vladislav Izmodenov. Currently, one of the projects of our scientific group is the proposal of the LYMUS instrument, which will be installed on a new Russian lunar orbiter spacecraft. This instrument is developed in the cooperation between the scientific groups from Russia (Moscow State University and Space Research Institute of the Russian Academy of Sciences), Japan (the University of Tokyo) and France (LATMOS).

The LYMUS instrument is a hydrogen cell equipped photometer which will be the first Russian instrument designed for the global monitoring of the backscattered Lyman-alpha radiation.

Our Japanese colleagues from the laboratory of Prof. Ichiro Yoshikawa have a broad expertise in creating the scientific equipment of this type, for example, the LAICA instrument. For the LYMUS device, they are going to provide us with a microchannel plate detector.

The results of my stay in Tokyo are:

Acquiring more deep understanding of the photometer construction and operation.

Especially, I obtained a lot of new knowledge on how the microchannel plate detectors work and how they are constructed, became acquainted with the designs of the photometers the Prof. Yoshikawa's group has been developing for other missions, and was able to see with my own eyes how the testing of such equipment is performed in the laboratory.

Calculation of the necessary exposure times for the different parts of the proposed scientific mission.

The LYMUS mission will consist of a number of different tasks such as the global monitoring of the heliolatitudinal variations of the solar wind mass flux during the different phases of the solar cycle, observation of the Earth's geocorona, diagnostics of the active regions located at the back from the Earth side of the Sun, monitoring of the interstellar hydrogen distribution inside the heliosphere, observation of comets and discovering new comets.

For each of this tasks different modes of observation should be proposed. In particular, the mode of the device operation will depend on the signal-to-noise ratio, which will be different for the different types of the objects observed. Understanding of the characteristics

of the microchannel plate detector and other parts of the device (mirrors, hydrogen cell) provided me to understand how the exposure time should be chosen for the different objects of observation.

Creation of an algorithm which can be used to make full Lyman-alpha radiation maps of the sky in less than one day.

The LYMUS device will be able to rotate its detector around only one axis, which will be fixed with the respect to the spacecraft. Thus, we are able to choose the direction of the observation, but this opportunity is restricted due to the spacecraft's own motion around the Moon. Due to this it is not a trivial goal to create an algorithm which will provide us to maintain the correct exposure time and to quickly create the full sky maps simultaneously.

During my stay in Tokyo, I created an algorithm with use of which we will be able to create full sky maps in less than one day. Such sky maps can be used for the monitoring of the heliolatitudinal variations of the solar wind mass flux.

Moreover, during my stay in Tokyo I've learned a lot about Japanese culture and cuisine. I am deeply grateful to Prof. Ichiro Yoshikawa, Prof. Shingo Kameda, Prof. Kazuo Yoshioka, Mr. Masaki Kuwabara, Mr. Fumiharu Suzuki and Ms. Reina Hikida for their assistance and their hospitality.