

Results Of Ground Experiments Using A Small Telescope Like Pzt For Observation Of Lunar Rotation And A New Proposal For Miniaturization

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Observations of lunar rotation using a telescope like PZT are possibly to detect the lunar rotational fluctuations related to partial melting zone or a liquid core inside of the Moon if the accuracy is better than 1 milli-arc second.

Development of the PZT type telescope for observations of lunar rotation has been made, and we have a Bread Board Model (BBM) for ground experiments. Some developments were made for the BBM such as a new tripod and a stable mercury pool. We performed laboratory experiments and field observations from August to September of 2014, in order to check the total system of the telescope and the software.

The results of the preliminary observations show that the variation of stellar positions is better than 0.1 arc-second in the laboratory and is about 0.4 arc-seconds in the case of field observations. The difference in standard deviation (SD) of the variation is partly due to different signal to noise ratio (SNR) of stellar images. This characteristic is confirmed also by numerical simulations. Coefficient of inverse proportionality, however, is different between for these experiments and for the simulations, that is the SD becomes 7.4×10^{-8} m when SNR=100 for the simulations, whereas it was about 1×10^{-5} m for the experiments. A possible cause for the difference is distortion of stellar images which are quite different from the Gauss distribution. Distortion of the image is partly due to aberration of the lenses and partly due to vibration of mercury surface.

On the other hand, we propose a new method to control the attitude of the tube by making it to be a reverse pendulum. This method can open the new way in the future mission with a small and light telescope for observation of rotation on the Moon or on the planet.