Development of a thermally tuned tandem etalon for Mercury Sodium Atmosphere Spectral Imager on BepiColombo/MMO

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In Mercury's thin atmosphere, H, He, O, Na, K, and Ca have been detected by optical observations. Sodium is the most observed species due to its strong emission line, NaD1 and NaD2. In past work, the suggested release mechanisms of sodium atoms are chemical sputtering, thermal desorption, photon-stimulated desorption, ion sputtering, and micro-meteoroid vaporization, and other species should be released by similar mechanisms. Photon-stimulated desorption should be a dominant release process from the results of laboratory experiments. However, solar wind ion sputtering should be dominant for explaining the observed bright emissions at high latitudes. A comprehensive description of the phenomena is still not available, mainly because a ground-based observation of Mercury's sodium is difficult due to its proximity to the Sun.

We are developing Mercury's Sodium Atmosphere Spectral Imager (MSASI) for BepiColombo/MMO (Mercury Magnetospheric Orbiter). A tandem Fabry-Perot Interferometer (FPI) is planned to be loaded on MSASI to achieve the spectral resolution of ˜100,000 at 589 nm (NaD2). The spectral transmission characteristic of the tandem FPI is very sensitive to the temperature change, which is estimated from -20 to +60 degC at the orbit of MMO. To solve this problem, we designed the thermally-tuned etalons and carried out thermal vacuum tests of them. The results are summarized as follow: (1) at -20 degC and +60 degC, the thermal tuning system still works, however, the spectral resolution decrease significantly and (2) after heating from +25 to +60 degC, cooling to -20 degC, and heating to 25 degC, the spectral resolution recovers that of the tandem FPI before heating and cooling. We report the result of the thermal vacuum tests in this presentation.