Design of a telescopic camera and a multi-band wide-angle camera onboard the Mars Moons Exploration mission

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The Japan Aerospace Exploration Agency (JAXA) is planning the Martian Moons Exploration (MMX) mission to reveal the origin of Phobos and Deimos which are satellites of Mars. This mission will observe the two satellites as well as Mars and return samples from Phobos. We designed a telescopic camera (TL) and a multi-band wide-angle camera (WAM), which are installed onboard the MMX spacecraft.
The objective of TL is to reveal the geographical features of Phobos. We must find a flat area for landing point and identify rocks and craters. We designed the telescopic camera with a spatial pixel resolution of 10 cm/pix at the surface of Phobos when the spacecraft is at an altitude of 20 km. This resolution is twenty times higher than that of the telephoto camera (ONC-T) onboard *Hayabusa2*. We also discuss the selection of the focus position and the effect of temperature on the performance of the camera.
The objective of WAM is to determine the distribution of the materials on the surface of Phobos. We cannot get multiband images with the wide-angle camera onboard *Hayabusa2* because it has only a monochrome sensor. Moreover, the ONC-T with seven band-pass filters placed on a wheel results in a fault that its field of view is shifted during wheel rotation when the spacecraft is descending. Therefore, we designed seven wide-angle cameras with narrow band filters to simultaneously take images at all wavelengths. The depth of field of WAM is 1m to infinity such that we can determine the distribution of materials during landing and orbiting around Phobos.
In this presentation, we illustrate the design of these cameras.

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