Development of CdTe gamma-ray detector for in-situ observations of planetary elemental composition

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For a study of the origin and eveolution of a planet, its chemical composition holds an important information. The abundances of certain elements with different condensation temperature and with various types of geochemical behavior can provide valuable information for its history.

Gamma-ray lines from the planet generally used to determine the chemical composition of a planet without atmosphere. These gamma-ray lines are produded by the decay of natural radionuclides or nuclear-reactions between planetary material and galactic cosmic rays. Abundance of elements is determined by measuring the intensity of gamma-ray lines specific to each element. From a orbital remote-sensing observation, global distribution of elements is acquired but its spatial resolution is limited, ˜10s km, because of difficulty of collimation of gamma-rays.

Therefore in-situ gamma-ray observation is necessary to measure the elemental abundances in meter-scale topography. To survey the gamma-ray flux, a gamma-ray detector on a rover on a planet is desired. Because of its limited electrical power and weight resources, we are developing small gamma-ray detector using a Cadmium Telluride (CdTe) semiconductor.

CdTe has been regarded as a promising semiconductor material for gamma-ray detector because of such features
as room temperature operation and large band-gap energy. The high atomic number of the materials gives a high absorption efficiency.

Here we present the development status and simulation results for the lunar observation.