SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 1 (2A)

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AN OVERVIEW OF CHINESE YUTU LUNAR ROBOTIC ROVER PAYLOADS

Abstract

1 Mission. Chinese Chang'E-3 spacecraft, which include a Lander and a robotic rover (YuTu), landed successfully on moon at 13:11 UTC on December 14, 2013. The scientific objectives of the YuTu rover were to: examine the texture, mineralogy, and structure of the local lunar terrain; determine the distribution and composition of minerals, rocks, and soils. Four kinds of scientific instruments are chosen for YuTu rover, which include panoramic cameras, lunar radar, IR acousto-optic spectrometer, and X-ray spectrometer .

2 Scientific Payloads.

2.1 Panoramic cameras.

Pancam is a high-resolution color stereo pair of CMOS cameras used to image the surface of Moon. The cameras are located on a camera bar that sits on top of the mast of the rover. The Mast allows the cameras to rotate a full 360 to obtain a panoramic view of the lunar landscape for scientists to determine the mineralogy, texture, and structure of the local terrain. Scientists also use cameras to search for interesting rocks and soils to study. The camera field of view is 2352 x 1728 pixels in size.

2.2 Lunar penetrating radar.

LPR which is similar to ground-penetrating radar for geological observations, is designed to study the lunar soil depth and structure of the shallow crust. LPR uses high-frequency radio waves and transmits into the ground. When the wave hits a boundary with different dielectric constants, the receiving antenna records variations in the reflected signal. Two bands are chosen for LPR and anticipated depth range of LPR are 30m and 150m respectively.

2.3 Acousto-optic spectrometer.

In-situ spectral imaging can determine the mineralogical makeup of the local site. Acousto-optic spectrometer consists of two optical channels which separately tune over VIS/near-IR and IR bands, extending to about 2.4 um. Tuning of both channels is accomplished using RF-excited acousto-optic tunable filters. The short wavelength focal plane is a CMOS array and HgCdTe IR detector for the IR channel. Spectral resolving power is typically 200 300.

2.4 X-Ray Spectrometer.

X-ray Spectrometer was designed to determine the chemical compositions of both soil and rocks along the traverse of the rover. The main parts of instrument were a sensor head with a preamplifier mounted on the robot arm and electronics located in the Payload Electronics Box inside the rover's body. The radioactive sources employed are four Fe-55 isotopes and four Cd-109 isotopes. The energy resolution (FWHM) of the sensor was about 134 eV at 5.9 keV.