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SCIENCE HIGHLIGHTS OF KPLO GAMMA-RAY SPECTROMETER IN CRUISE AND THE LUNAR ORBIT

Abstract

The KPLO orbiter (Danuri) was launched by a SpaceX Falcon 9 rocket from Cape Canaveral Space Force Station on August 5, 2022 (KST). The Danuri is carrying six scientific instruments, including a gamma-ray spectrometer (KPLO Gamma-Ray Spectrometer, KGRS). KPLO's lunar trajectory follows a low-energy, fuel-efficient ballistic lunar transfer (BLT) trajectory, with a travel time of 4 months and 3 weeks until it reached the lunar orbit at an altitude of 100 km on December 27, 2022. The KGRS accomplished its scientific objectives by monitoring both gamma-ray bursts and gamma-ray backgrounds in deep space. After arriving in the lunar orbit, the KGRS has successfully collected gamma-ray data to produce elemental maps for investigating lunar geology and resources. The nominal mission phase of KPLO is one year, including one month of the commissioning phase. Gamma-ray bursts (GRBs) are the most energetic explosions known to humankind. Although GRBs were discovered in 1967 by the Vela Satellite Network, the physics of GRBs remains unsolved. KGRS collected a number of gamma-ray burst signals during the cruise period, and it was specifically designed to measure GRB counting variation with five channels corresponding to five gamma-ray energy intervals. The most interesting result of KGRS in deep space was the detection of the strongest gamma-ray burst in measurement history, known as GRB221009A. At the time of the event (October 9, 2022), KPLO was at a distance of 1.508 million kilometers from Earth. The GRB221009A was detected at 13:21 (KST) and lasted approximately six minutes. This could be the first promising data of a gamma-ray burst in deep space obtained by a gamma-ray instrument on board a spacecraft for planetary surface investigation. This presentation includes a summary of KGRS's gamma-ray results obtained from both deep space and the lunar orbit of KPLO, as

well as prospective plans associated with applications to investigate lunar resources using the elemental data from KGRS.