Preliminary Design of Wide-Angle Polarimetric Camera for the First Korean Lunar Mission. M. Jeong¹, Y.-J. Choi¹², S. S. Kim³, K.-I. Kang³, Y. G. Shkuratov⁴, V. G. Kaydash⁵, G. Videen⁶, C. K. Sim³, I.-H. Kim³, ¹Korea Astronomy and Space Science Institute, 776, Daeedokdae-ro, Daejeon, Korea (msjeong@kasi.re.kr), ²University of Science and Technology, 217, Gajeong-ro, Yuseong-gu, Daejeon, Korea, ³Kyung Hee University, 1732 Deogyeong-daero, Yongin-si, Korea, ⁴Korea Advanced Institute of Science and Technology, 291 Daehak-ro, Daejeon, Korea, ⁵Astronomical Institute of Kharkov National University, 35 Sumska St, Kharkiv, Ukraine, ⁶Space Science Institute, 4750 Walnut St. Suite 205, Boulder CO, USA

Introduction: Polarimetry data contain surface information such as the grain size, maturity, and porosity of the regolith [1,2,3]. However, few detailed polarimetric studies of the lunar surface have been performed [4], in part because polarimetric instrumentation has not been incorporated into a lunar orbiter. We plan to perform polarimetry in lunar orbit through the Korea Pathfinder Lunar Orbiter (KPLO), which will be launched around 2018/2019 as the first Korean lunar mission. A Wide-Angle Polarimetric Camera (PolCam) is one of the onboard instruments for the KPLO. The science objectives are the following: (1) to obtain polarization data of the whole lunar surface at wavelengths 320 nm, 430 nm and 750 nm for a phase angle range from 0° to 135° with a spatial resolution of ~100 m; and (2) to obtain the reflectance ratios at 320 nm and 430 nm for the whole lunar surface with a spatial resolution of ~100 m. We will briefly introduce the preliminary design of the PolCam and its operation concept.

Theory of operation: PolCam has two optics systems, both of which are tilted from the nadir toward the lateral direction by 45°. The oblique observation allows us to obtain phase angles larger than 90°. The phase-angle coverage for each color band range is from 0° to 135°. This coverage is important for polarimetry because the polarimetric response is dependant on the phase angle. Additionally, the polarization maximum, which is a quantifiable parameter, occurs near a phase angle of 100°. For this reason, the PolCam has a lateral FOV. PolCam has three color bands that are 320, 430, and 750 nm with polarization filters. Each optic has a configuration of 320nm/0°(TBD), 320nm/90°(TBD), 430nm/0°, 430nm/60°, 430nm/120°, 750nm/0°, and 750nm/90°, respectively. The swath width of PolCam is about 35 km at an altitude of 100 km with oblique observation, and the spatial resolution is approximately 100 m. PolCam has been constructed of two parts that are an electronix box and optics box. The optics box is installed on the nadir plate of the KPLO and the electronics box is installed inside of KPLO near the onboard computer.

![Figure 1](image1.png) The concept of operation for PolCam. PolCam is plan to perform with oblique pointing from the nadir toward the lateral direction by 45°.

![Figure 2](image2.png) Preliminary design (upper) and specifications (bottom) of PolCam.