

Polarimetric observations of the Moon as a function of phase with the PACE HARP2 instrument

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The Hyper-Angular Rainbow Polarimeter (HARP2) on NASA's Plankton Aerosol Cloud ocean Ecosystem (PACE) mission is the first polarimetric imaging sensor in low-Earth orbit capable of regular imaging observations of the Moon in polarized light and over a wide variety of phase angles. Over the mission, HARP2 has observed the Moon on a monthly cadence at $\pm 7^\circ$ and -55° phase for radiometric trending and intercomparison with VIIRS, respectively. Based on needs of the Ocean Color Instrument (OCI), intercomparisons with Airborne Lunar Spectral Irradiance (AirLUSI) field campaigns, and lucrative science opportunities, PACE has also targeted over 15 other phase measurements between -55 and $+55^\circ$ to date.

Of these, the *inversion angle* (phase ~ 23 - 25°), the phase where the disk-integrated surface signal is unpolarized, is demonstrated as a promising on-orbit polarimetric zero point validation opportunity for PACE and future polarimetric missions. While legacy Earth observation missions, such as MODIS, stage a repeatable view at a single phase for long-term radiometric trending, these observations at a wide variety of lunar angles positions PACE as a pathfinder for expanded on-orbit cal/val techniques and lunar modeling.

In this work, we present the HARP2 disk-integrated polarimetric measurements of the lunar surface as a function of phase and wavelength, and compare these to recent ground-based results from Montana State University [1], including corrections for libration [2]. We discuss how upcoming polarimetric missions can plan for inversion angle measurements, and look ahead towards leveraging these HARP2 observations to derive lunar regolith properties [3,4] and support global efforts in polarized lunar irradiance modeling.

References

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Preferred mode of presentation: Oral