**ABSTRACT**

It is known that sunlight reflected from the lunar surface is partially polarized. Measurements of the Moon by partially polarizing optical remote sensing instruments may therefore depend on the relative orientation of the instrument axis with the scattering plane. There are circumstances when polarizing effects could become significant, such as when instruments are simultaneously significantly polarizing, at short wavelengths (toward UV), and at phase angles > 100 degrees, when the degree of polarization of light reflected from a surface peaks. At phase angles larger than 100 degrees, polarization decreases.

The SOLar Stellar Irradiance Comparison Experiment (SOLSTICE) on the SOLar Radiation and Climate Experiment (SORCE) has been observing the Moon in the ultraviolet (115 – 300 nm) over a wide range of phase angles (0 to ~170°) on a routine basis since June 2006. We have noted a relatively wide distribution of reflectance measurements at any one phase angle and suspect that this may be due to polarisation effects. This summer, we searched for correlations between the geometry of the instrument, the Sun, and the Moon. In order to obtain a relatively wide distribution of reflectance measurements at any one phase angle and suspect that this may be due to polarisation effects.

**BACKGROUND**

**SOLSTICE**

NASA-sponsored satellite mission that is providing state-of-the-art measurements of incoming x-ray, ultraviolet, visible, near-infrared, and total solar radiation. The measurements provided by SORCE specifically address long-term climate change, natural variability and enhanced climate prediction, and atmospheric ozone and UV-B radiation.

**SORCE (SOLar Radiation and Climate Experiment)**

The SORCE (SOL lar Radiation and Climate Experiment) is one of four solar irradiance measurement experiments that was launched as part of the Solar Radiation and Climate Experiment (SORCE) on January 25, 2003, and is a follow-on to the very successful SORCE (SOL lar Radiation and Climate Experiment) launched aboard the Upper Atmospheric Research Satellite (UARS) in 1991 (Robinson et al., 1992). The new SOLSTICE makes daily solar ultraviolet (115–320 nm) irradiance measurements and compares them to the irradiance from an ensemble of 18 stable early-type stars.

**SOLSTICE A & B**

The SOLar Stellar Irradiance Comparison Experiment (SOLSTICE) is one of four solar irradiance measurement experiments that was launched as part of the Solar Radiation and Climate Experiment (SORCE) on January 25, 2003. SOLSTICE is a follow-on to the very successful SORCE (SOL lar Radiation and Climate Experiment) launched aboard the Upper Atmospheric Research Satellite (UARS) in 1991 (Robinson et al., 1992). The new SOLSTICE makes daily solar ultraviolet (115–320 nm) irradiance measurements and compares them to the irradiance from an ensemble of 18 stable early-type stars.

**SOLSTICE SET-UP**

SOLSTICE is a grating spectrometer, with a field of view of about 2 degrees. This means the entire moon is shown in our measurements (“disk-integrated”). The detector is a photomultiplier tube that measures one wavelength at a time by changing the rotation of the grating. Plane waves, incident on the grating, are diffracted into zero and first order. Rotating the grating causes the diffraction angles to change. Since we have a wide range of roll-angles for any given phase angle of SOLSTICE data, we are able to determine the polarization.

**POLARIZATION**

The fractional linear polarization of a beam of light from a body is defined as:

\[ P = \frac{I_2 - I_2^*}{I_2 + I_2^*} \]

Where \( I \) is the magnitude of the beam which is oriented such that the electric vector is perpendicular to the scattering plane, and \( I^* \) is the magnitude of the beam which is oriented such that the electric vector parallel to the scattering plane. Polarization ranges from +1 to -1, with 0 being unpolarized light.

**PHOTOMETRY**

The study of the variation in the brightness of a surface or body as a function of the illumination and viewing geometry. Mathematical functions are used to model this variation, and it is essential for computing the reflectance of one surface to another for different viewing geometries.

**Preliminary Results**

Filtered outliers (points greater than 2 sigmas from the mean); filtered obviously suspicious data; tried parsing various intervals of degrees for the x-axis (10 degrees, 20 degrees, 30 degrees, etc.); and altered the y-axis to show the percentage of polarization rather than just the polarization itself.

**CONCLUSIONS**

When making a plot of phase angle vs. percentage of polarization, we were able to extrapolate a curve between the data from SOLSTICE at 250 nm and the curve of percent polarization of the moon at visible wavelengths.

This correlation is much lower than expected, however, and there is still a great deal of noise in the data. Further steps could be to determine why the measurements in the middle ultraviolet (MUV) are not congruous with our predictions, and to suggest possible solutions for more data collection.

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