Geophysical Research Abstracts
Vol. 20, EGU2018-6119, 2018
EGU General Assembly 2018

CubEshine: a cube-sat project for earthshine observations of the Moon.

Peter Thejll (1), Aroh Barjatya (2), Ted von Hippel (2), Constantine Lukashin (3), Hans Gleisner (1), and Chris Flynn (4)

(1) Danish Meteorological Institute, Climate and Arctic Research, Copenhagen, Denmark (pth@dmi.dk), (2) Embry-Riddle Aeronautical University, USA, (3) NASA Langley Research Center, USA, (4) Centre for Astrophysics and Supercomputing, Swinburne University of Technology, Australia

Observations of the intensity of earthshine on the Moon can be used to constrain terrestrial shortwave albedo in the hemispheric-average sense. This can be important as an independent alternative to Earth-Observation satellite data products. Terrestrial observation of the earthshine intensity on the dark side of the Moon is an economical method to gather such data with roots in astronomical photometry and benefits hugely from decades of experience in instrumentation, data-gathering, and data-reductions.

We have operated one such terrestrial earthshine telescope from the NOAA observatory on Mauna Loa on Hawaii. The telescope is based on a small-aperture refractor obtaining 1x1 degree high-dynamic range images of the Moon and its surrounding sky. The strong light on the sun-lit side of the Moon is scattered in the Earth's atmosphere and in the telescope. Variability of the scattered halo indicates that even from a dry, clear and stable site such as Mauna Loa the atmospheric contribution to scattered light is variable and considerable, while scattering and diffraction in the telescope optics plays a, at times, minor part. We attempt to eliminate scattered light from both sources by image-analysis, including forward modelling of scattered light. This has indicated that photometric stability below but near 1\% is possible. For terrestrial albedo studies in connection with climate change investigations, it would be advantageous if the error on terrestrial albedo could be brought down nearer to the 0.1\% level. This seems very difficult to achieve using Earth-based telescopes.

Placing a small automated telescope in low Earth orbit, on a cube-satellite for instance, would eliminate the issues due to the atmospheric scattering - and add challenges of a different nature. In this poster we explore some ideas around a possible design of an earthshine telescope suitable for a 3U to a 6U CubeSat form factor.