The Kordylewsky Clouds - An Example for a Cruise Phase Observation during the LUNAR MISSION BW1

In October 1956 the Polish astronomer Kazimierz Kordylewski (1903-1981) observed the Lunar Libration Clouds at the libration points L4 and L5 visually for the first time. In March and April of 1961 he took photographs of the clouds and published his findings in Acta Astronomica. Since then a number of observers have obtained visual evidence, photographic exposures or took space-based measurements.

The faint clouds are hard to detect from Earth and were never the primary target of a space based mission. We propose a dedicated search and measurement campaign for the Kordylewsky Clouds during the cruise phase of the Lunar Mission BW1 spacecraft.

The contact times to the Lunar Libration Clouds and their equatorial coordinates at those times were calculated using the Satellite Tool Kit software developed by AGI (Analytical Graphics, Inc.)

In this case STK was used to solve the inter-visibility problems between a ground based observer, the Lunar Mission BW1 spacecraft and the L4 and L5 points. The observer’s position was assumed to be the building of the Institute of Space Systems (IRS), Stuttgart, Germany.

The simulations show that it is possible to observe the clouds from the Lunar Mission BW1 spacecraft almost any time during the transfer through cis-lunar space.

A simulation conducted with a trajectory close to the last orbit before lunar capture (305,000×180,000 km, 21 deg inclination, similar to the SMART-1 capture orbit) showed the spacecraft can get as close as 58,000 km to the clouds. This close proximity will significantly enhance the observation quality.

The contact times of a ground based observer to the L4 and L5 libration points are much shorter.

About 10 to 15 opportunities are available each month to observe the clouds from the assumed position. The contact duration lasts from a few minutes up to six hours.

The tables below list the longest contact durations and the equatorial coordinates for each month from February 2007 until February 2009.

Comparison of the contact times to the libration points for the Lunar Mission BW1 spacecraft and the building of the Institute of Space Systems (IRS), Stuttgart, Germany. The contact times were calculated from Jan 1st, 2007 (Julian Date: 2454319.5) until Jan 1st, 2010 (Julian Date: 2455479.5).

The ground based observations are constrained by a sun elevation angle of 18° and a lunar elevation angle of 18°. For the observation times from the spacecraft, exclusion angles of 20° for the sun and the moon were assumed.

Longest observation opportunities of the Kordylewsky clouds from the building of the Institute of Space Systems (IRS), Stuttgart, Germany. For more detailed contact times and coordinates for your observatory please contact Prof. Oliver Ziehe (ziehe@irs.uni-stuttgart.de).