Mini-SAR Data Analysis for Studying Wapowski Crater in Lunar South Polar Region

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Abstract

MiniSAR data conveniently reveals various crater features in completely or partially shadowed regions of the lunar south poles (ex: crater ejecta blanket, relative crater volume/depth, morphological features within craters, direction of meteoritic impact etc.). Circular Polarization Ratio (CPR) values for different pixels derived from SAR data show the surface roughness as well as scattering attributed to presence of planetary ice in partially or completely shadowed polar craters. CPR values may also vary depending on the freshness of the proximal ejecta blanket. Relatively high CPR values can show the extent and symmetry of the ejecta blanket as well.

Mini-SAR data analysis was done with calculation of stokes parameters derived for each pixel using ENVI software. The Stokes vectors were subsequently used for quantitative measurement of factors such as degree of polarization (m), circular polarization ratio (CPR) and Poincare Ellipticity Parameter (χ) which along with total backscattered power (S0) were used to make m- χ decomposition images. Decomposition images with RGB colour composite show blue color for 'surface' scattering from surface, 'red' colour for double bounce scattering from crater wall and ground surface and green colour for volume or diffuse scattering. m-χ decomposition images for surface, double bounce and volume backscattering further reveal the surface and regolith features within and around crater rims.

Wapowski crater is a small impact crater located just at the rim of Scott crater at the lunar south polar region lying roughly at 83°3'11" S and 53°45'17"E. The crater diameter is 11.6 km approximately. CPR values both inside and outside the crater rim are relatively high suggesting the presence of rough surfaces possibly due to features such as blocky lava flow or fresh blocky ejecta. Decomposition images show the presence of diffuse or double bounce scattering mechanism from region having rough surfaces. Since the CPR values inside and outside the crater rim are high and quantitatively similar, the presence of water ice within the crater can be ruled out. m-χ decomposition images show that the high CPR values correspond to the diffuse backscattering regions also showing the extent and asymmetric nature of the rough ejecta.

Optical images of the region from wide angle camera (WAC) on board LRO mission also show the presence of chain of secondary craters possibly formed by the impact of smaller pieces of debri from the larger impact. Mini-SAR total backscatter power and m- χ decomposition images further substantiate the presence of these secondary craters.

Keywords: *mini-SAR, Wapowski crater, CPR, backscatter, m-chi decomposition, regolith*