Closer look at photometric anomalies and phase reddening on Vesta

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In the full year that Dawn orbited Vesta, the onboard Framing Camera acquired thousands of images in eight different filters. This data set is ideally suited to study the resolved photometric properties of the asteroid surface. In [1], we adopted a simple exponential model for the photometric phase curve, and mapped the distribution of the amplitude and slope model parameters. As expected, the amplitude closely correlates with the albedo. The slope parameter is generally inversely correlated with albedo with local exceptions, mostly associated with craters of youthful appearance (Cornelia, Antonia). We found the phase curve to be shallow on the wall of these craters and steep on their ejecta, and interpreted this in terms of regolith roughness associated with the relatively short exposure to space weathering [2]. Our parameter maps were constructed from images acquired on approach to Vesta, and therefore of low resolution (0.5–1 km/pixel), and did not cover the full surface. Here we investigate the photometric properties of several craters in the gaps of this map by means of the phase ratio technique [3], and take a closer look at some of the photometric anomalies identified in [1]. In addition, we study the wavelength dependence of the phase curve ("phase reddening") associated with several photometrically extreme terrains with good phase-angle coverage. Phase reddening was previously identified for Vesta globally [4,5], but has not yet been studied locally.

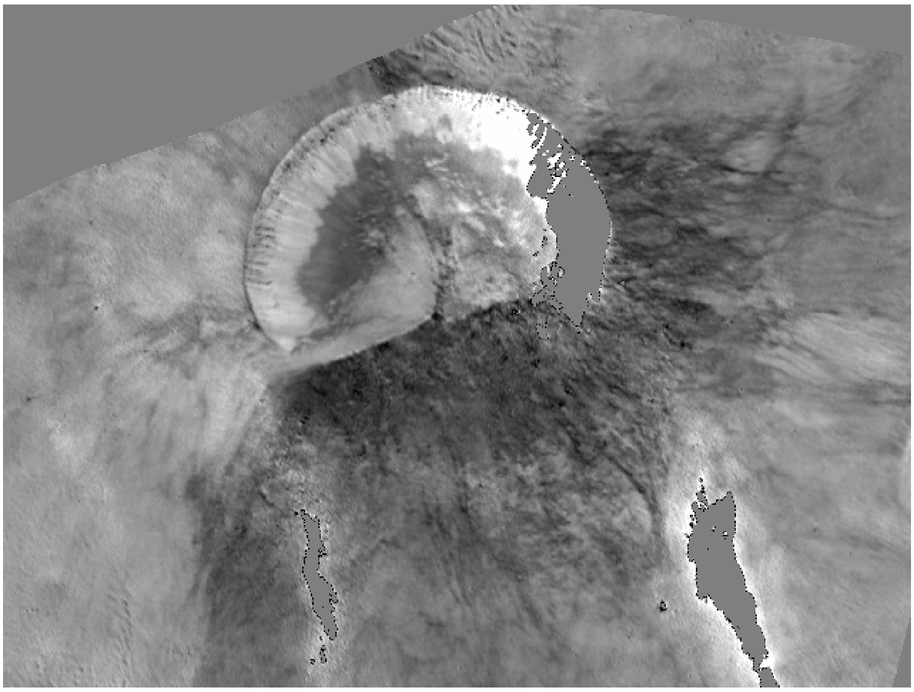

Figure: A phase-ratio image of the Antonia crater (201°E, -59°), constructed by dividing an image acquired at a high phase angle (68°) by one acquired at a low phase angle (28°). Bright (dark) areas have a relatively shallow (steep) phase function.

References: [1] Schröder et al. (2013) P&SS 85, 198. [2] Pieters et al. (2012) Nature 491, 79. [3] Korokhin et al. (2010) P&SS 58, 1298. [4] Li et al. (2013) Icarus 226, 1252. [5] Schröder et al. (2014) Icarus 234, 99.