

Photometric Analysis of 1 Ceres and Surface Mapping from HST Observations

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Due to the maximum number of authors allowed for each abstract at submission, the following coauthors are not listed above: S. Alan Stern, Department of Space Studies, Southwest Research Institute, 1050 Walnut Street, Boulder, CO 80302, USA; Peter C. Thomas, Center for Radiophysics and Space Research, Cornell University, Ithaca, NY 14853, USA; Mark V. Sykes, Planetary Science Institute, 1700 East Fort Lowell, Tucson, AZ 85719, USA. To support the upcoming NASA Discovery Program mission, Dawn, one of its two targets, Ceres, has been observed by Hubble Space Telescope (HST) with the Advanced Camera for Survey (ACS), at three wavelengths, 535 nm, 335 nm, and 223 nm, and covering more than one rotation of Ceres. The disk-resolved photometric properties have been studied with these images. The geometric albedos of Ceres at above three wavelengths are found to be 0.087+/-0.003, 0.056+/-0.002, and 0.039+/-0.003, respectively, assuming the same phase function as V-band. The V-band rotational lightcurve is consistent with previous ground-based observations in terms of both the shape and the absolute brightness. Combined with earlier HST observations and visible spectrum of Ceres, our observation shows a strong and broad absorption band centered at \sim 280 nm, with a FWHM of \sim 120 nm. The albedo at the absorption band center is only about 30% of that outside the band. Hapke's modeling gives the single-scattering albedos of 0.070+/-0.002, 0.046+/-0.002, and 0.032+/-0.003, respectively, at the three wavelengths. A photometric roughness parameter, 44+/-5 deg, is found, consistent with previous estimate from both IR observations and radar measurements. The roughness is higher than most asteroids and comets. The first global surface maps of Ceres have been constructed from these images and the photometric modeling, at the three wavelengths. They show a surface with brightness variations of only 6%, and color variations of only 4%. Eleven surface features are identified, with slightly different albedos and colors from the surrounding areas.