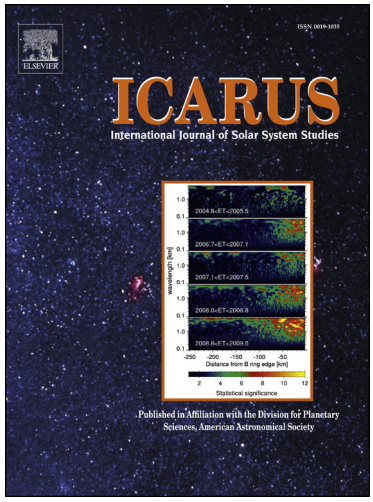

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In-flight calibration of the Dawn Framing Camera II: Flat fields and stray light correction

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Abstract

The NASA Dawn spacecraft acquired thousands of images of asteroid Vesta during its year-long orbital tour, and is now on its way to asteroid Ceres. A method for calibrating images acquired by the onboard Framing Camera was described by Schröder et al. (2013; Icarus 226, 1304). However, their method is only valid for point sources. In this paper we extend the calibration to images of extended sources like Vesta. For this, we devise a first-order correction for in-field stray light, which is known to plague images taken through the narrow band filters, and revise the flat fields that were acquired in an integrating sphere before launch. We used calibrated images of the Vesta surface to construct simple photometric models for all filters, that allow us to study how the spectrum changes with increasing phase angle (phase reddening). In combination with these models, our calibration method can be used to create near-seamless mosaics that are radiometrically accurate to a few percent. Such mosaics are provided in JVesta, the Vesta version of the JMARS geographic information system.

Keywords: Data reduction techniques, asteroid Vesta, photometry

1. Introduction

The NASA Dawn spacecraft left asteroid Vesta in August 2012 after a successful science campaign, and is on its way to rendezvous with asteroid Ceres in April 2015. A method for calibrating images of both models of the onboard Framing Camera (FC1 and FC2) based on in-flight observations was outlined by Schröder et al. (2013a). However, their calibration is only valid for point sources. To extend the method to resolved images of Vesta, it is necessary to characterize and correct for in-field stray light that is known to affect FC narrow band images of extended sources (Sierks et al., 2011; Schröder et al., 2013a). It was realized after the launch of Dawn that in-field stray light also affects the images of the inside of an integrating sphere from which the flat fields were derived. It it therefore necessary to revise these flat fields as well. Such a revision also benefits from a comprehensive analysis of the thousands of images of Vesta acquired through each filter. Removing the stray light according to our method