GLOBAL RESOLVED TEMPERATURE MAPS OF VESTA. F. Tosi[1], F. Zambon[1], M.T. Capria[1], M.C. De Sanctis[1], F. Capaccioni[1], E. Ammannito[1], T.N. Titus[2], E. Palomba[1], C.T. Russell[3], C.A. Raymond[4], and the Dawn Science Team. [1]INAF-IAPS, Via del Fosso del Cavaliere 100, I-00133 Rome, Italy, federico.tosi@iaps.inaf.it. [2]U.S. Geological Survey, Astrogeology Science Center, Flagstaff, AZ, USA. [3]University of California at Los Angeles, Los Angeles, CA, USA. [4]NASA/Jet Propulsion Laboratory and California Institute of Technology, Pasadena, CA, USA.

Introduction: We present, for the first time, global resolved temperature maps of Vesta as derived by the Visible and Infrared Mapping Spectrometer (VIR) onboard Dawn [1].

On the day side of Vesta, the region of the infrared spectrum beyond ~3.5 μm is dominated by the thermal emission of the asteroid's surface, which can be used to determine surface temperature by means of temperature-retrieval algorithms. To calculate surface temperatures, we applied a Bayesian approach to nonlinear inversion [2] based on the Kirchhoff law $r_\lambda=1-\varepsilon_\lambda$ and the Planck function. Results were compared with those provided by the application of alternative methods (e.g, [3]). In all cases, the minimum retrievable temperature (~180 K) is set by the Noise Equivalent Spectral Radiance (NESR), i.e. the RMS noise of the in-flight measurements expressed in units of spectral radiance. On the other hand, for a given local solar time (LST), the maximum temperature depends on the local incidence angle and surface properties such as thermal inertia, surface roughness, emissivity and Bond albedo.

Results: Such investigation in the case of Vesta has allowed us to derive spatially-resolved thermal images of a significant percentage of the asteroid, with a formal error in the computation which is generally smaller than 1 K for surface temperatures greater than 220 K. Previous results were obtained for local scale features, such as local concentrations of unusual brightness i.e. high-albedo (bright) and low-albedo (dark) material units [4], pitted terrains [5], and spectrally distinct meteorite impact ejecta. The size of Vesta, far larger than that of other asteroids explored by spacecraft, also makes this work the first of its kind for the amount of data and the overall surface area covered.

Temperature maps are divided by mission phase: Approach, Survey, High Altitude Mapping Orbit (HAMO), Low Altitude Mapping Orbit (LAMO), High Altitude Mapping Orbit 2 (HAMO-2), and local solar time intervals. These products can be used to identify regions of Vesta for which temperature measurements carried out in multiple times of the Vestan day are available.

Thermal emission, especially when measured at different points in time, can provide clues to the physical structure of such peculiar sites, which complements the mineralogical investigation based on VIR data collected at shorter wavelengths. A separate project [i.e., 6] is devoted to derive global thermal inertia maps and other thermal properties of Vesta using theoretical models which solve the heat equation for airless bodies and model the distribution of temperatures due to surface roughness variations.

Conclusions and future work: The availability of surface temperature maps for each phase of the Dawn mission at Vesta is a fundamental step for a comprehenive understanding of the surface. In fact, these data are crucial for both the mineralogical analysis and for the determination of thermophysical properties.

It is expected to undertake a similar analysis when Cere data acquired by VIR will be available.

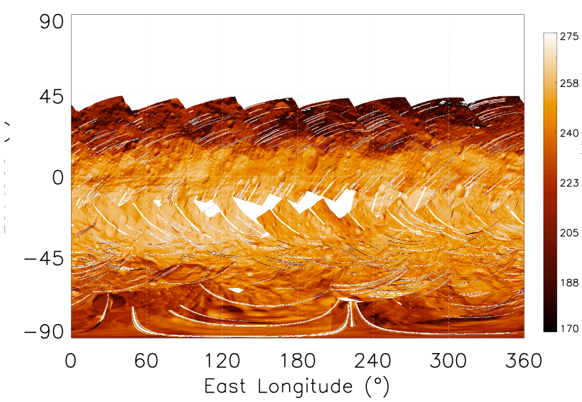

Fig. 1. Map of surface temperature derived by VIR infrared data acquired in the Survey phase. All local solar times are represented here.

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the Planetary Data System Small Bodies Node (http://pdssbn.astro.umd.edu/).

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