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Dawn's Exploration of 4 Vesta in 2011

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The Dawn spacecraft, launched on September 7th 2007 and fueled by an ion engine, will perform a dual-rendezvous mission to protoplanets Vesta and Ceres in the main asteroid belt. Dawn's first target is Vesta, a dry differentiated body that is thought to be the source of the Howardite-Eucrite-Diogeneite meteorites. Dawn will spend roughly a year at Vesta studying its surface and gravity field to determine its geologic history and to establish the relationship between Vesta and the HEDs. The Dawn Framing Camera (FC from Max Planck/Lindau and DLR) will obtain image mosaics in multiple color filters at < 100 m/px spatial resolution, and partial coverage of the body at ∼25 m/px resolution, to map the geology, geomorphology, tectonic fabric and characterize space weathering. Multi-angle clear filter images will be obtained and used to construct a topographic model to 100 m spatial resolution and 10 m height accuracy. The Visible and InfraRed Spectrometer (VIR from ASI and INAF/Rome) maps the spectral variations on the surface between 0.25 and 5 microns to resolve mineralogy, geologic units, weathering effects and thermal brightness variations. The elemental composition of the surface is resolved to ∼10 spatial pixels by the Gamma Ray and Neutron Detector (GRaND from LANL/PSI). Together with the spherical harmonic gravity field derived from high-accuracy navigation (by JPL/GSFC), these observations will provide a comprehensive data set to investigate Vesta's primordial evolution (serial magmatism versus magma ocean), tectonic history, the effects of impacts, in particular the large impact that formed the south polar basin, and weathering of the surface over time. Dawn will begin its approach to entering orbit around Vesta in May of 2011. During the Approach Phase several rotational characterizations will be performed to update Vesta's pole, finalize instrument calibrations, and tune exposure times for imaging instruments. Dawn enters its Survey orbit in August of 2011, observing Vesta for six orbits over 18 days at a mean radius of 3000 km, while the sun is at its highest southern latitudes. After achieving global color and multispectral maps with FC and VIR, the spacecraft transfers to the High-Altitude Mapping Orbit (HAMO – mean radius 950 km) using the ion-propulsion system. In HAMO Dawn performs detailed global mapping in multiple color filters with the FC, while VIR collects high-resolution multispectral data in the southern hemisphere. Multi-angle off-nadir mappings in the FC clear filter are performed to derive the topographic model. After 30 days in HAMO, Dawn transfers to the Low-Altitude Mapping Orbit (LAMO - mean radius of 460 km), where the Gamma Ray and Neutron Detector (GRaND from LANL/PSI) will map Vesta for nominally 70 days, while daily tracking passes will map the gravity field to degree and order 20. Near-global high-resolution nadir imaging will be collected in LAMO, along with selected VIR targets. Following LAMO, Dawn will begin to spiral out for departure to Ceres, but will stop at HAMO altitude to observe the newly illuminated terrain in the northern polar region, and complete the topographic mapping of Vesta. Departure to Ceres is scheduled for July 25, 2012 to meet the arrival date of February 1, 2015. A similar observation plan will be performed at Ceres.