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The OSIRIS cameras on Rosetta – Results from Deep Impact and remote observations of the Rosetta target asteroids

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After the launch of Rosetta on 2 March 2004 and a successful commissioning phase the scientific cameras on Rosetta, OSIRIS, were used for scientific observations for the first time when comet 9P/Tempel 1 was hit by the Deep Impact projectile. OSIRIS monitored the comet continuously from 5 days before to 10 days after the impact. The relative proximity of Rosetta to the comet (0.53 AU compared to 0.89 AU from Earth) and the solar elongation of slightly more than 90 degrees were favorable for camera observations from Rosetta.

The Narrow Angle Camera (NAC) monitored the cometary dust in four medium bandwidth filters and in a clear filter. The Wide Angle Camera (WAC) observed in wavelengths of emissions from OH, CN, NA, and OI together with the associated continuum.

Before and after the impact the comet showed regular variations in intensity. The period of the brightness changes is consistent with the rotation period of Tempel 1. The overall brightness of Tempel 1 decreased by about 10 % during the OSIRIS observations.

The analysis of the impact ejecta shows no new coma structures created by the impact. Most of the material moved with $\sim$200 m/s. The light curve of the comet after the impact and the amount of material leaving the comet (4.5-9 x 10^6 kg of water ice and a presumably larger amount of dust) suggest that the impact ejecta were quickly accelerated by collisions with gas molecules. Much of the material left the comet in the form of icy grains which sublimated and fragmented within the first hour after the impact.

The impact ejecta are quickly accelerated by gas in the near-nucleus region. The motion of the ejecta cannot be described by ballistic trajectories. Therefore, density and tensile strength of the nucleus of Tempel 1 cannot be determined with models using ballistic ejection of particles.

Rosetta will flyby Asteroids (2867) Steins in Sept. 2008 and (21) Lutetia in June 2010. Knowledge of the rotation period and the orientation of the spin axis of the asteroids are valuable information for the flyby preparation. The orientation of the rotation axis is determined by remote observations of its light curve from different observer positions relative to the asteroid and the sun. In March 2006, the OSIRIS NAC observed (2867) Steins from a distance of 1.06 AU and at a phase angle of 42 degrees, an observing geometry not achievable from Earth. The NAC acquired 238 images of (2867) Steins during 24 hours, continuously covering 4 rotation periods.

The OSIRIS data show a double peaked lieght curve with an amplitude of $\sim$0.23 magnitudes and a synodic rotation period of 6.052 ± 0.007 hours, in good agreement with groundbased determinations. The continuous observations over four rotations completely exclude the possibility of period ambiguities. There is no indication of deviation from a principal axis rotation state. The absolute visual brightness estimated from the OSIRIS measurements is 13.05 ± 0.03. The observations are being combined with Earth-based data sets to derive the orientation of the spin axis and pole position for 2867 Steins.

We will present the results from the observations of comet Tempel 1 and asteroid Steins. First results from observations of asteroid Lutetia in January 2007 and from the Rosetta Mars flyby in Feb. 2007 may also be reported.