Observations of comet 9P/Tempel 1 around the Deep Impact event with the OSIRIS cameras on Rosetta

H. U. Keller, M. Küppers, M. Rengel (1), S. Fornasier (2), G. Cremonese (3), P. Gutierrez (4), W. H. Ip (5), J. Knollenberg (6), L. Jorda (7)

(1) MPI für Sonnensystemforschung, Germany, (2) Università de Padova, Italy, (3) INAF-OAPD Padova, Italy, (4) Instituto Astofísica de Andalucía, Spain, (5) National Central University, Taiwan, China (6) Deutsches Zentrum für Luft- und Raumfahrt, Germany, (7) Laboratoire d'Astrophysique de Marseille, France

The scientific imaging system OSIRIS on Rosetta observed comet 9P/Tempel 1 nearly continuously from 5 days before it was hit by the Deep Impact projectile on 4 July 2005 to 10 days after the impact. The narrow angle camera (NAC) of OSIRIS monitored the evolution of the impact created dust cloud with a resolution of 1500 km/pixel through different filters in the red and near infrared spectral region. The time resolution in each filter was 1.5-3 hours except for the 2 hours around impact when it was increased to better than a minute. In a circular aperture of 8 arcsec radius (3000 km at the comet) the brightness of the comet increased by a factor of 4.5 within 40 minutes after the impact, with the light curve showing several changes in slope during the first minutes. We interpret the observations by a crater formation in at most a few minutes, followed by brightening due to changes in optical depth and material released from sublimating grains. A few hours after the impact, the expanding dust cloud (typical velocity 200 m/s) did not brighten any more. Its cone shape gradually changed when it was pushed away from the sun by solar radiation pressure. Dust created by the impact could be identified for approximately a week.

The wide angle camera (WAC) observed the comet in emissions of OH and OI (tracers for water production), CN, and Na with a resolution of 7800 km/pixel. About 6000 metric tons of water were created in the impact, corresponding to a dust/gas ratio of $\sim$2.5. The abundance ratio between the CN parent molecule(s) and H_2O was higher in the impact ejecta than in the coma resulting from normal cometary activity. While Sodium D-line emission was not found in the cometary coma before or days after the impact, it was detected in the first hours after the impact. The Na/H_2O ratio in the impact ejecta was approximately 10^{-7}. This is the first detection of sodium in a comet at a heliocentric distance larger than 1.4 AU.