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Cometary physics observed by OSIRIS during the Rosetta rendezvous

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The OSIRIS scientific cameras - wide angle WAC and narrow angle NAC - were designed to reveal details of the cometary nucleus, its immediate environment, and relevant physical processes. The rendezvous of Rosetta with the comet 67P Churyumov-Gerasimenko will start at a heliocentric distance of more than 4 AU and formally end at perihelion at 1.29 AU. OSIRIS will be used to detect the comet and to determine its nucleus shape and spin state and to find a suitable landing site for Philae, the Rosetta lander.

Even after flybys of four cometary nuclei little is known about the physical processes controlling the activity of comets. We will discuss how observations of OSIRIS will contribute to our understanding of cometary activity. OSIRIS should reveal how the activity in form of dust ejection from certain surface areas works in detail and how it can be maintained over several orbits of the comet around the sun. How is the dust accelerated by the gas above the active areas? Where is the transition from Knudsen flow to a Maxwell distribution? How are collimated dust jets created? OSIRIS can directly observe centimetre sized particles being lifted off the surface when activity is sufficiently high near perihelion. OSIRIS will accurately and quantitatively determine how much of the surface material is lost due to activity.

Morphology and topography of the nuclei observed during the flybys look remarkably different from comet to comet. At least in the case of the best observed nucleus of comet Tempel 1 there is pronounced variegation of the surface morphology. High resolution mapping and super high resolution (down to a few centimetres) spot imaging will tell us about the formation processes of the nucleus and its evolution in the inner solar system.