Approaching Comet Churyumov-Gerasimenko

31 July 2014

Less than 2000 kilometres separate the ESA orbiter Rosetta and the Philae lander from their destination, Comet 67P/Churyumov-Gerasimenko. Images acquired with the OSIRIS camera system already indicate what lies ahead for the orbiter and lander upon arrival: "The surface seems pretty rough. We will have to wait to determine whether the visible depressions are impact craters or structures produced by cometary activity," says Ekkehard Kührt from the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR). The comet researcher is involved in the acquisition of data by the OSIRIS camera and is also responsible for data analysis. Another image taken by the camera shows that a cloud of dust, the coma, enshrouds the comet. “As we draw closer to Churyumov-Gerasimenko, the other instruments used in the mission will provide us with interesting insights into the interaction between the dust and the surrounding gas.”

The icy constituents sublimate as comets approach the Sun: gases are emitted, carrying dust particles at a speed of up to several hundred metres per second. “At the moment, we do not have a precise understanding of cometary activity.” The current image of the coma, dated 25 July 2014, was taken with an exposure time of 330 seconds to capture the light reflected by the dust particles. Due to the comet’s own brightness, parts of the image were overexposed (around the comet nucleus), causing scattered light to produce an artefact – a hazy, glowing structure to the right of the nucleus. Nevertheless, it is clear that the coma, which extends around the comet and covers an area of 150 by 150 square kilometres, thins out increasingly towards its periphery. The image only shows the inner part of the coma, containing the greatest density of dust particles.

The OSIRIS camera identified a dust cloud surrounding the comet back at the end of April – at the time still over 2,000,000 kilometres away. Now, the scientists at the DLR Institute of Planetary Research are waiting with bated breath for other instruments, among them the spectrometer VIRTIS, in which they were contributing partners, to deliver data on the gases that carry the dust particles from the surface of the comet into space. “Possible candidates include water molecules, carbon monoxide and carbon dioxide.”

The comet’s rough surface

The image of the comet acquired on 29 July 2014 shows the rough surface of Churyumov-Gerasimenko, a comet shaped somewhat like a rubber duck. The particularly light regions, for instance along the narrow ridge between ‘head’ and ‘body’, are particularly striking. This colouring may result from a high proportion of ice, although different granularity or topography could just as well be cause of the non-uniform brightness. “At the moment, we simply cannot make any confident statements,” says Kührt.

The scientists and engineers in the Philae team are going to have to exercise some patience before searching for a suitable landing site: “At the moment, we do not really have a clear enough view of the surface,” says Stephan Ulamec from DLR, project manager responsible for the landing. The lander, scheduled to complete the first ever landing on a comet on 11 November, will be controlled and operated from the Lander Control Centre at DLR in Cologne. The Rosetta orbiter will arrive at Churyumov-Gerasimenko on 6 August. First, it will acquire close-up images of, and map, the surface. The roughness of the comet’s surface, also its activity, are important criteria to ensure that Philae touches down safely. “Naturally, we would prefer to land on flat terrain – if possible, at a site not located directly adjacent to a crevasse emitting gas.”

About the mission

Rosetta is a European Space Agency mission with contributions from its Member States and NASA. Rosetta's Philae lander has been contributed by a consortium led by DLR, MPS, the French space agency, CNES (Centre National d'Études Spatiales), and the Italian space agency, ASI (Agenzia Spaziale Italiana).

The OSIRIS camera system was developed by a consortium under the leadership of MPS (Germany) in cooperation with the Center of Studies and Activities in Space (Centro Interdipartimentale di Studi e Attività Spaziali; CISAS) at the University of Padua (Italy), the Laboratoire d'Astrophysique de Marseille (LAM) at Aix-Marseille University (France), the Andalusian Institute of Astrophysics (Instituto de Astrofísica de Andalucía) of the Spanish National Research Council (Consejo Superior de Investigaciones Científicas; CSIC), the ESA Scientific Support Office, the Spanish National Institute for Aerospace Technology (Instituto Nacional de Técnica Aeroespacial; INTA), the Technical University of Madrid (Spain), the Department of Physics and Astronomy at Uppsala University (Sweden), and the Institute of Computer and Network Engineering the Technical University of Braunschweig (Germany). OSIRIS has been financially supported by the national agencies of Germany (DLR), France (CNES), Italy (ASI), Spain (MEC) and Sweden (SNSB), and by ESA's Technical Directorate.

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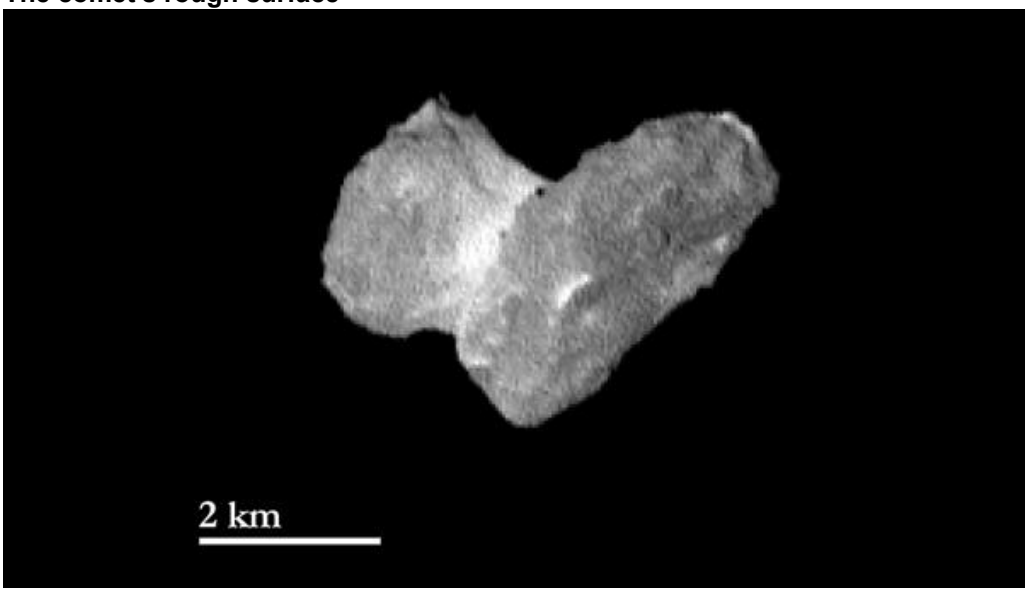
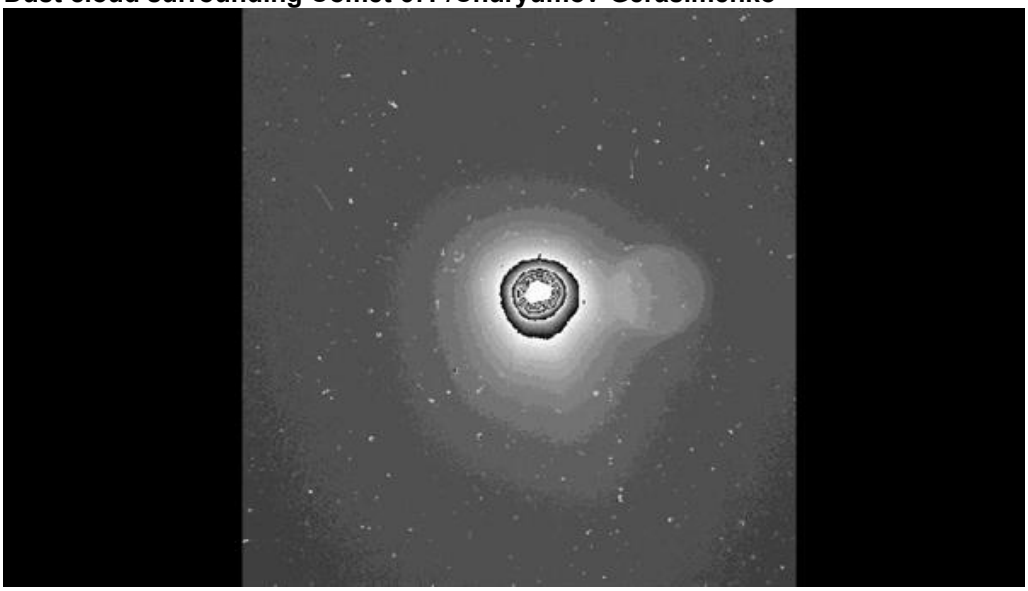
The comet's rough surface



The image acquired by the OSIRIS camera on 29 July 2014 shows Comet 67P/Churyumov-Gerasimenko from a distance of 1950 kilometres. The resolution is about 37 metres per pixel.

Credit: ESA/Rosetta/MPS für OSIRIS-Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA.

Dust cloud surrounding Comet 67P/Churyumov-Gerasimenko



The dust cloud, or coma, surrounding Comet 67P/Churyumov-Gerasimenko extends over an area of 150 by 150 kilometres. The image was acquired on 25 July 2014 with an exposure time of 330 seconds. Due to the overexposure of the bright nucleus, artifacts such as the blurred light structure to the right of the nucleus and at the centre of the nucleus have been created.

Credit: ESA/Rosetta/MPS für OSIRIS-Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA.

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