



Surface of Comet 67P/Churyumov-Gerasimenko too hot for ice

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Record cold temperatures on Earth are far from the low point on a comet formed from ice and dust. Researchers using the Visible and InfraRed Thermal Imaging Spectrometer (VIRTIS) on board ESA's comet rendezvous spacecraft, Rosetta, have determined that the average temperature on Comet 67P/Churyumov-Gerasimenko is a mere minus 70 degrees Celsius. This is where, in November 2014, the lander Philae – constructed and operated by a consortium led by the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR) will touch down. “At this temperature, the surface of the comet is not completely covered with a layer of ice, but with dark, dusty material,” says DLR planetary researcher Gabriele Arnold, who heads the German scientific contributions to this experiment. The temperature was measured during Rosetta's approach to the comet, where it is due to arrive on 6 August 2014.

The investigations of the nucleus with VIRTIS began in July this year. At this point, the spacecraft was still 14,000–5000 kilometres from the target comet and, at that time, the comet filled only a few pixels of the image. “The temperature therefore represents an average over the visible cometary surface.” Individual regions are not recorded in detail and may well be covered with ice. With the average of minus 70 degrees Celsius, the temperature is 20 to 30 degrees above the value at which a comet would be completely covered with ice. The scientists in the VIRTIS team suspect that the surface is largely covered with a crust of dark dust, which is heated by the Sun; this energy is then reradiated in the infrared wavelength range. DLR comet researcher Ekkehard Kührt, who is also involved in VIRTIS, concludes from the first model calculations that: “The relatively high temperatures suggest that the dusty surface must be very rough.”

Information for selecting the landing site

“As Rosetta approaches the comet, images and the corresponding spectra will be acquired with continuously increasing spatial resolution,” explains Arnold. This will allow scientists to study the detailed structure of the surface of the nucleus, its composition, and physical parameters such as the temperature and thermal inertia of the surface material. This will be especially interesting when Rosetta and VIRTIS accompany the comet on its journey towards the Sun. At the time these measurements were performed, Comet 67P/Churyumov-Gerasimenko was still 543 million kilometres from the Sun. VIRTIS is designed to measure the composition of the nucleus and the daily changes in its surface temperature over selected regions, to better understand the comet and its structure. VIRTIS will provide information on the thermal conditions and the material structure at possible landing sites and assist, together with other instruments, in the selection of the optimum landing site.

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, the Max Planck Institute for Solar System Research (Max-Planck-Institut für Sonnensystemforschung; MPS), the French space agency, CNES (Centre National d'Études Spatiales), and the Italian space agency, ASI (Agenzia Spaziale Italiana).

VIRTIS is the visible/infrared spectrometer on board ESA's Rosetta spacecraft. It will provide information on the composition of the nucleus, and map the distribution of the material on the surface and molecules and gases in the coma. VIRTIS was developed by a consortium under the scientific direction of the Institute for Space Astrophysics and Planetology (Istituto di

Astrofisica e Planetologia Spaziali; IAPS) of the National Institute for Astrophysics (Istituto Nazionale di Astrofisica; INAF), in Rome (Italy), which also manages the scientific operations. The consortium includes the Laboratory for Space Studies and Astrophysics Instrumentation (Laboratoire d'Études Spatiales et d'Instrumentation en Astrophysique; LESIA) of the Observatoire de Paris (France) and the DLR Institute of Planetary Research in Berlin (Germany). The development of the instrument was funded and coordinated by the national space agencies ASI, CNES and DLR. The support provided by the Rosetta Science Operations Centre and the Rosetta Mission Operations Centre is appreciated. The calibrated VIRTIS data will be available on the ESA Planetary Science Archive Website: www.rssd.esa.int/index.php?project=PSA&page=index

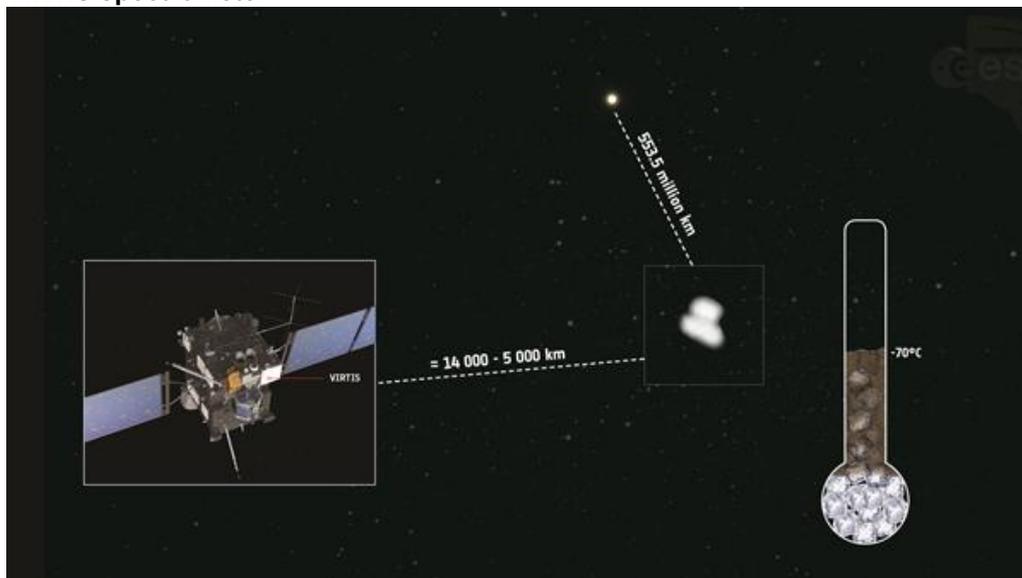
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VIRTIS spectrometer



The VIRTIS spectrometer travels on board ESA's comet rendezvous spacecraft, Rosetta. Initial measurements have determined that the average temperature of Comet 67P/Churyumov-Gerasimenko is too high for it to be completely covered with ice. The surface of the nucleus is probably covered with dark, dusty material.

Credit: ESA.

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