Comet Churyumov-Gerasimenko – neither ball nor potato

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Comets have irregular and rather potato-like shapes – this is a well-known fact. But the comet 67P/Churyumov-Gerasimenko, on which the Philae lander is scheduled to descend in November 2014, has an unexpected shape. The pictures acquired by the OSIRIS camera on board the European Space Agency (ESA) Rosetta spacecraft – just 14,000 kilometres from its target – show that the comet is a contact binary, consisting of two parts in close contact. "This shape is most surprising," says comet researcher Ekkehard Kührt from the German Aerospace Center (Deutsches Zentrum für Luft- und Raumfahrt; DLR). For 30 years, the project leader has been studying these celestial bodies for scientific experiments on the probe and lander. "But it is not unlikely. Comets were formed by the collision of small building blocks far away from the Sun during the emergence of the Solar System." The effect of the comet's unusual shape on the landing cannot be estimated yet.

Fused together 4.5 billion years ago

Rosetta and the Philae lander are currently less than 10,000 kilometres away from their destination. So far, Churyumov-Gerasimenko has been an enigma for scientists: only recordings from a distance, such as those from the Hubble Space Telescope or the first images of OSIRIS as well as the navigation camera provide clues of what the orbiter and lander will encounter. Previous observations estimated the comet to be about three by five kilometres in size. The fact that two clearly distinguishable parts make up Churyumov-Gerasimenko is a surprise. "The two blocks likely formed 4.5 billion years ago, collided at low speed, stuck to each other and have since been moving together," says Kührt. "Scientifically, it is now of course very interesting to find out whether the two components differ in their composition." If the two parts are from different regions, their structure might also differ.

Waiting for details

In the coming months, as the spacecraft get closer to their target, the scientists will learn more about the comet. "For the landing, it is especially important to have a detailed view of the comet and understand how the two parts are connected," says Koen Geurts, an engineer at the Lander Control Centre at DLR in Cologne. This information will be incorporated into the planning of the trajectory of Rosetta spacecraft – and its course and height in turn has an impact on the landing of Philae, as it is the first time that a lander touches down on a comet and performs in situ measurements. "So far, it looks as though there are large flat regions on the comet." The location where the two parts are connected will likely not be considered as the landing site. In addition to being a suitable, reasonably flat terrain, the landing site should also have a day-night cycle so that the Philae lander can cool down out of the sunlight and so that scientific research can be carried out under different conditions. Regular communication with the Rosetta spacecraft is necessary for the lander team to send the recorded data to Earth and empty the data storage. "These aspects are currently still hard to assess."

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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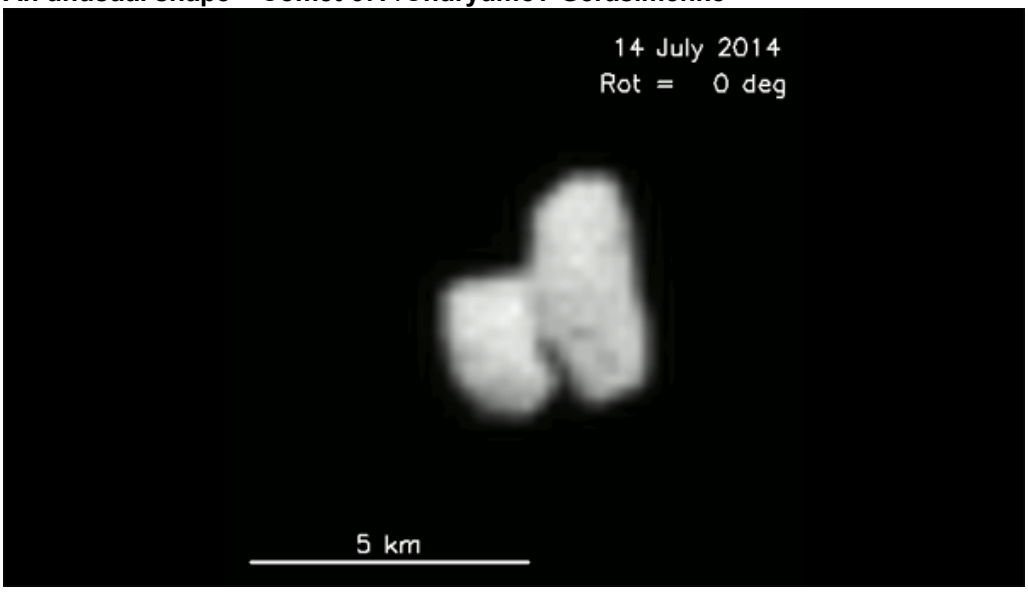
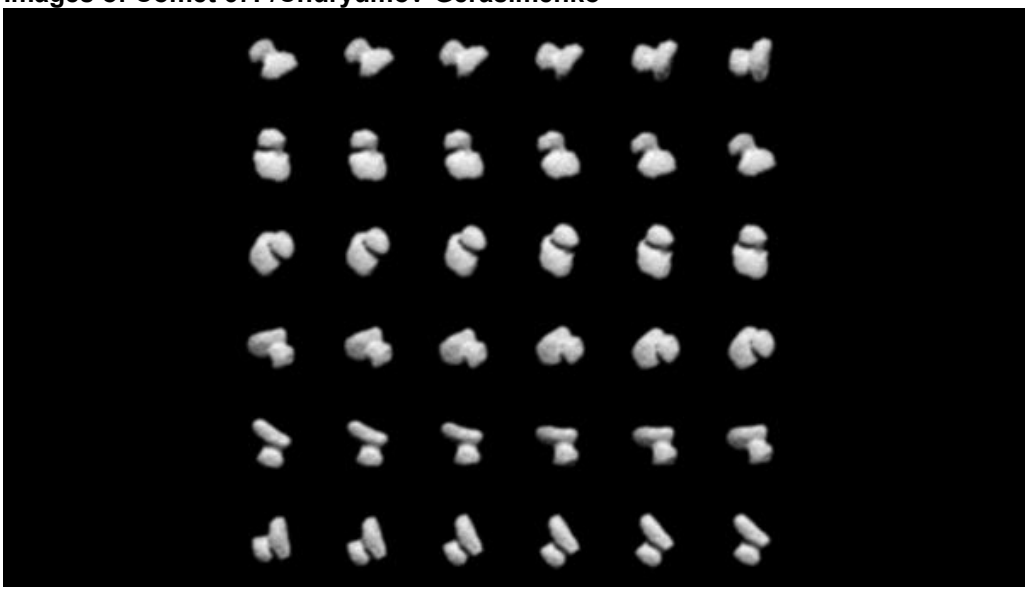
An unusual shape – Comet 67P/Churyumov-Gerasimenko



The shape of comet 67P/Churyumov-Gerasimenko is particularly unusual; these 36 combined and interpolated images were acquired by the OSIRIS camera on 14 July 2014 at intervals of 20 minutes and show that the comet consists of two interconnected parts.

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

Images of Comet 67P/Churyumov-Gerasimenko



These 36 images were acquired by the OSIRIS camera on the Rosetta spacecraft on 14 July 2014 at intervals of 20 minutes. The images have been processed to smooth the still pixelated view. Nevertheless, the recordings give a first impression of what the Rosetta Lander, Philae, will encounter at its destination.

Credit: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA/ Montage: DLR.

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