ONE MONTH AFTER COMET RENDEZVOUS – ROSETTA AT EPSC

More than 800 scientists are gathering this week in Cascais, Portugal, for the 2014 European Planetary Science Congress (EPSC). One of the highlights of this year’s meeting is a special session dedicated to Rosetta, taking place today.

It is just over one month since Rosetta arrived at comet 67P/Churyumov-Gerasimenko. Since then, the spacecraft has been edging closer to the nucleus, moving from a distance of 100 km from the comet surface on 6 August to less than 50 km today. Over the course of the next few weeks, the spacecraft will move even closer to the comet as it prepares to dispatch the lander Philae to the surface in November.

From the perspective of the science operations teams, this is a period of the highest activity of any ESA mission, with numerous parallel operations ongoing to plan activities for the near (pre-landing and landing) and long term (post landing). For the instrument teams, this has also been a period of intense activity as they pore over the data coming in from their instruments, eager to see what is revealed by these first measurements from the vicinity of the comet. In addition, several of the teams have been contributing to the time-critical landing site selection process with the analysis and delivery of essential scientific measurements. A shortlist of five candidate landing sites has already been drawn up and the primary site will be announced next week.

This morning, at the dedicated Rosetta session at EPSC, the teams have the opportunity to share some of the first results and recent updates with scientists from the planetary science community.

We expect to hear more about the first results that have been reported from the imaging and spectroscopy instruments: Alice, MIRO, OSIRIS and VIRTIS. We’ll also get updates from MIDAS, GIADA and COSIMA about their investigations into dust at the comet (follow the links for recent news about these instruments; for recent images from both OSIRIS and NAVCAM, click here).

RPC has been investigating the comet’s plasma environment and ROSINA has been monitoring density variations as well as measuring some of the rare chemical species in the coma – both teams will present the status of these studies.

In the afternoon, attention will turn to Rosetta’s lander Philae. We will hear from the Philae lead scientists about the unique science that is anticipated when Rosetta’s lander makes contact with the comet nucleus, as well as about the landing site selection activities that are currently on-going.

Stay tuned to the blog for updates during the day.
A PRELIMINARY MAP OF ROSETTA'S COMET

Scientists working on images of comet 67P/Churyumov-Gerasimenko have divided the comet's surface into a number of different regions based on their morphology, revealing a unique, multifaceted world.

Several morphologically different regions are indicated in this preliminary map, which is oriented with the comet’s ‘body’ in the foreground and the ‘head’ in the background.

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

The map and new high-resolution images from the OSIRIS instrument were presented during the Rosetta special session at EPSC today.

With various areas dominated by cliffs, depressions, craters, boulders or even parallel grooves, 67P/C-G displays a multitude of different terrains. Some areas even appear to have been shaped by the comet’s activity.

This preliminary analysis provides the basis for a detailed scientific description of the comet's
surface, but a substantial amount of work involving more detailed OSIRIS images and data from other Rosetta instruments lies ahead to determine what each region represents in terms of their composition and evolution. One recent image from the OSIRIS narrow-angle camera is also shown here.

![Image of Rosetta landing site](image.jpg)

Jagged cliffs and prominent boulders are visible in this image taken by OSIRIS on 5 September 2014 from a distance of 62 kilometres from comet 67P/Cheyumov-Gerasimenko. The left part of the image shows a side view of the comet's 'body', while the right is the back of its 'head'. One pixel corresponds to 1.1 metres. Credits: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA

As both 67P/C-G and Rosetta travel closer to the Sun over the next months, the OSIRIS team will monitor the surface looking for changes. While the scientists do not expect the borderlines of the comet's regions to vary dramatically during this one passage around the Sun, more subtle transformations of the surface may nevertheless help to explain how cometary activity created such a breath-taking world.

Next weekend, on 13 and 14 September 2014, the maps will play a key role as Rosetta's Lander Team and the Rosetta orbiter scientists gather at CNES, Toulouse to determine a primary and backup landing site from the earlier pre-selection of five candidates.
COSIMA CATCHES COSMIC DUST

While many of us spend time trying to eliminate dust, Rosetta’s COSIMA team have a different attitude – they are actively attempting to catch it. Today we heard that they succeeded and have the picture to prove it!

At the European Planetary Science Congress (EPSC) held in Lisbon, Portugal, the COSIMA team presented an image of the first dust grains collected by the COSIMA instrument when Rosetta was at a distance of less than 100 km from the nucleus of comet 67P/Churyumov-Gerasimenko.

COSIMA studies dust in situ by capturing grains on small (1 cm by 1 cm) target plates, first imaging these with an optical microscope and then analysing the composition of selected grains using a secondary ion mass spectrometer. The instrument is designed to investigate dust grains larger than about 10 microns.

COSIMA catches first dust grains. Left: an image of the target plate (measuring 1 cm by 1 cm) on which the grains were collected; right: a section of the plate showing the state on 17 August (top) when no dust grains were visible and 24 August (bottom) when some large dust grains were detected. The plate is illuminated from the right by LEDs and the length of the shadows is proportional to the height of the dust grains. The resolution of the image is 14 microns per pixel.


Early in the morning of 11 August, the first of COSIMA’s 24 target plates was exposed to space. As the team mentioned in a previous blog post, models of 67P/C-G’s coma suggest that at the present low level of activity, it should be comparable to a high-quality cleanroom – in other words, there should not be many dust particles. They therefore decided to expose this plate for at least one month and to check back periodically to see if they had been lucky and something had been picked up at this early stage.
On 24 August, when the COSIMA team looked at the image of the plate they saw a number of large dust grains from the comet on a target that had been pristine when examined one week before. A first examination of the plate indicates that the largest two grains are about 50 microns and 70 microns in width, comparable to the width of a human hair.

Scientists from the COSIMA team are now examining the image of the target plate in detail to determine the locations of the dust grains. Some will be selected for further analysis: the target plate will be moved to place each chosen grain under an ion gun which will then ablate the grain layer by layer. The material is then analysed in a secondary ion mass spectrometer to determine its composition.

The results of these investigations are eagerly awaited since these are among the first dust grains to have been collected from beyond the Solar System's snow line – the distance from the Sun at which ice grains can form.

COSIMA is one of three instruments on Rosetta that will study cometary dust, the other two being GIADA and MIDAS. In mid August, the GIADA team reported the detection of four dust grains, ranging in width from a few tens of microns up to a few hundreds of microns, collected when Rosetta was between 814 and 179 km from the comet.

Errol Coder says: 08/09/2014 at 17:38
What is this “dust” mainly composed of? When I imagine dust, I picture minerals and other material common to Earth “dust”. But, this posts seems to reference ice. Does that mean even they term dust was used to describe the “dust plume” captured in the 8/31 images, may also be composed of out-gassing ice verses just what we would typically think of “dust”? Is there anyway to determine the composition of the out-gassing of these couple plumes from the surface we are seeing, and to see how much of it is either actual gas, verses, ice, versus minerals?

Reply

Errol Coder says: 08/09/2014 at 17:43
After reading the GIADA thread, it answered my question. The dust is a combination of the silicates etc and the ice it is encased in when released due to sublimation. I guess my question is whether or not other forms of gas has been monitored to be released from the ice other then water vapor, of which will be answered from any of the spectroscopy results.

Reply

Peon says: 10/09/2014 at 18:53
The reason it’s more like dust, is it’s not a ball of dirty ice. The Comet is an electrically charged rock, that occasionally has to discharge in the form of plasma. The surface is dark and dusty due to electric charring, and it’s double lobed because of it’s formation.

Reply
VIRTIS MAPS COMET 'HOT SPOTS'

The VIRTIS team have produced maps of the surface temperature of comet 67P/C-G showing how the temperature varies across regions and with local time. Some examples of these were shown today during the Rosetta special session at the European Planetary Science Congress (EPSC).

Over the past two months, the VIRTIS imaging spectrometer has recorded about three million spectra of the surface of 67P/C-G as Rosetta closed in from about 14000 km to less than 100 km from the comet's nucleus. One thing that can be extracted from these spectra is the surface temperature, which is derived from measurements of the radiation emitted in the spectral range 4.5 to 5.1 microns.

Back in mid-July, the first temperature measurements – made when the comet occupied just a few pixels in the VIRTIS field of view – yielded an average surface temperature of 205 K, already at that time ruling out a surface covered exclusively in ice.

By early August, as the comet filled more of the VIRTIS field of view, variations in the temperature could be seen, modulated by the comet's rotation period.

Following Rosetta's arrival at the comet on 6 August, the VIRTIS team have been able to map variations in the surface temperature across the nucleus. These data have been an essential input to the on-going landing site selection process since one of the criteria for choosing a site is that it be neither too hot nor too cold for the Philae lander.

Temperature measurements of the surface of comet 67P/Churyumov-Gerasimenko generated from data recorded by the VIRTIS instrument. The maps, on an orthographic projection of the comet's surface centred on the 0° meridian (left) and the 180° meridian (right), show the temperature for local time between 12h and 14h. The data were obtained in July and August 2014 when the comet was between 3.6AU and 3.45AU from the Sun, and the spacecraft was closing in from 14000km to less than 100 km from the comet nucleus. The locations of the five candidate landing sites for the Philae lander are indicated. Credit: ESA/Rosetta/VIRTIS/INAF-IAPS/OBS DE PARIS-LESIA/DLR

At the Rosetta special session today at the EPSC, the VIRTIS team described how they have made
temperatures maps of the entire sunlit surface of the comet, noting that temperatures as high as 230 K have been recorded. They have also been able to map how the surface temperature varies with local time – as can be seen in the figure above.

Measurements of the surface temperature can provide clues to the composition and physical properties of a comet. These new VIRTIS measurements have allowed the team to rule out some models of the comet surface and to favour a comet surface composed of a porous and highly thermally insulating dusty crust that is depleted of water ice. As they reported today, this is also consistent with the VIRTIS global measurements of thermal inertia – a measure of a body’s resistance to changes in temperature – that is compatible with the value for high porosity dusty materials.

The relatively high spatial resolution of the VIRTIS measurements have also allowed the team to investigate thermal shocks that happen when a region enters or exits from shadow. This is of interest because thermal shocks can give rise to stresses in the surface, which can lead to micro-cracks and eventually result in fractures in the surface.

The team have also been poring over the spectra to search for hints about the chemical makeup of the surface of comet 67P/C-G. Among the preliminary results reported today was no evidence of water ice on a global scale, confirming that the outer surface is generally dehydrated.

On the other hand, they see some strong hints of carbon-bearing compounds, with some spectral features that are compatible with the complex macromolecular carbonaceous materials found in the most primitive carbonaceous meteorites. These materials are often referred to as “organics”, even if their origin is unrelated to life.

The picture of comet 67P/C-G that is beginning to emerge from these early VIRTIS measurements is of a dark, dry, and dusty comet surface with a rich and complex chemistry.

Tractor says: 09/09/2014 at 08:50

My list of possible contents of comet and coma,

hydrogen, helium, neon, argon, krypton, xenon, oxygen, nitrogen, water ice, hydrocarbons like methane, ethane, diacetylene, methylacetylene, acetylene and propane, cyanoacetylene, hydrogen cyanide, carbon dioxide, carbon monoxide, cyanogen, polycyclic aromatic hydrocarbons, tholins, minerals in the composition of what is found in meteorites due to influence from the asteroid belt as it passes this regularly. Amino acids, RNA, DNA are present in meteorites so most likely the comet piked up that as well. And so due to the high energy radiation splitting molecules into atoms.

What of this the rosetta and philae are able to detect or what else might be found is beyond my knowledge, but i think my list covers the major part of it

The dark surface color is due to the sot and the tholins (tar). Hopefully this layer is not too thick for Philaes drill probe.

Dan Delany says: 09/09/2014 at 22:07

Worth noting that, while *nucleobases*, which are the building blocks of DNA/RNA, have been found in meteorites, DNA/RNA have not, to my knowledge. That would be much bigger news.
ROSETTA AND PHILAE SNAP SELFIE AT COMET

Using the CIVA imaging system on board Rosetta’s lander Philae, the spacecraft have snapped a ‘selfie’ at comet 67P/Churyumov-Gerasimenko.

Rosetta mission selfie at comet 67P/C-G, taken on 7 September. Credit: ESA/Rosetta/Philae/CIVA

CIVA, the Comet Infrared and Visible Analyser, is one of ten instruments onboard Philae. The CIVA-P part of the instrument comprises seven micro-cameras that will take a 360 degree panoramic image of the landing site at visible wavelengths, once Philae is safely on the surface of 67P/C-G, including a section in stereo. CIVA-M is a visible/infrared microscope imager/spectrometer that will study the composition, texture, and albedo of surface samples.

The latest selfie was taken during Sunday night from a distance of about 50 km from the comet, with one of CIVA-P’s cameras capturing the side of the Rosetta spacecraft and one of its 14 metre-long solar arrays, with 67P/C-G in the background.

Two images with different exposure times were combined to bring out the faint details in this very


high contrast situation.

The image was taken as part of the preparations being made for Philae, as the lander team gear up for the first ever attempt to land on a comet. It was presented at the EPSC conference this week, during a presentation highlighting the status of the lander. Next week, on 15 September, the primary landing site for Philae will be announced.
ROSINA TASTES THE COMET'S GASES

Rosetta’s ROSINA instrument, the Rosetta Orbiter Sensor for Ion and Neutral Analysis, has detected its first cometary volatile molecules. The results were presented at the European Planetary Science Congress, EPSC, held in Portugal this week.

The detections were made early August when Rosetta was within 200 km of comet 67P/Churyumov-Gerasimenko, and over 500 million kilometres from the Sun – the first time that a comet’s coma has been analysed in situ this far from the Sun.

Since then, ROSINA has been almost continuously measuring the density and the composition of the comet’s coma. It has already acquired more than 40,000 high- and low-resolution spectra with its two mass spectrometers (DFMS and RTOF).

Overall, the density of the coma is relatively low at this early stage, far from the Sun, but should increase as activity picks up, as the comet moves closer to the Sun over the next year. The density is seen to vary during the comet ‘day’, as it rotates over a 12.4 hour period.

As expected, the main species in the comet’s coma are found to be water, carbon monoxide, and carbon dioxide, which are being released from below the surface layer of the nucleus, which VIRTIS has shown to be dark, porous, and probably dry.

However, ROSINA has made the surprising observation that the ratio between these species varies quite significantly, depending on where in the coma Rosetta is. Sometimes carbon monoxide is almost as abundant as water; sometimes it’s only around 10%. In addition, ROSINA has not only detected these main species already, but many of the expected minor ones, such as ammonia, methane, and methanol.

As Rosetta gets closer to the comet and as comet activity increases, it will soon be possible to measure the ratio of hydrogen to deuterium – an isotope of hydrogen with an added neutron – in the cometary water. This ratio is constant in Earth’s...
ocean water and thus can be used as a way of tracing the still unknown origin of that water: for example, was it incorporated into the Earth at the time of formation, or was it delivered from space at some later date?

In particular, 67P/C-G is a Kuiper belt comet, and the hydrogen to deuterium ratio measured for its water will help constrain how much of Earth’s water could have come from a population of impacting Kuiper belt comets, soon after the birth of the Solar System.

Ross says:
11/09/2014 at 14:57

"As expected, the main species in the comet's coma are found to be water, carbon monoxide, and carbon dioxide, which are being released from below the surface layer of the nucleus, which VIRTIS has shown to be dark, porous, and probably dry."

Has rosetta actually observed these gasses being released directly from below the nucleus surface? If not, it bothers me that this mechanism is presented as fact when ROSINA has only detected the presence of these compounds in the coma. If this were true, OSIRIS should have produced thousands of images of newly formed vents which I hope will be released before more assumptions are made.

Reply

Jacob Nielsen says:
11/09/2014 at 15:30

If the surface is indeed porous, vents may not be a prerequisite for material leaving the comets interior. Besides, do You have a different hypothesis regarding the origin of these volatiles?

Reply

Ruben says:
11/09/2014 at 20:44

I think vents must be the jets that we can see from far away due to crevices on the ground of the comet (due to small gravity there is a very low compaction and must be too easy pull out fragments of the surface -in a very "soft" way-, this process refresh the surface and must be responsible for the burst in brighness that we can see sometimes).

I apologize for my English.

Reply
GIADA TRACKS THE DUST

Following the trail of a minuscule dust particle through the depths of space may seem far-fetched, but that is effectively what the GIADA team have been doing recently, as they described at the European Planetary Science Congress this week.

During the Rosetta special session at EPSC, the GIADA team reported the detection of 27 dust grains associated with Comet 67P/Churyumov-Gerasimenko during the month of August.

Four of the grains were detected as Rosetta was approaching the comet, nine during the first series of pyramid trajectories at a distance of about 90 km from the comet surface, and the other fourteen along the second series of pyramid trajectories at 60 km distance.

Positions along the Rosetta flight path of 27 dust grains (red dots) detected by GIADA in August 2014. Five grains (yellow dots) were detected by both the Grain Detection System and the Impact Sensor.

Image credit: ESA/Rosetta/GIADA/Univ Parthenope NA/INAF-OAC/IAA/INAF-APS

Of the 27 grains, five were seen by the Grain Detection System, which detects the grains and measures some of their optical properties, and also by the Impact Sensor, which measures their momentum.

Thus for this handful of grains, the team were able to measure their masses and velocities. Such measurements are particularly important, as they will allow the scientists to trace the paths of grains back to the comet and to even identify which regions on the comet they may have been ejected from. For these first five grains, that analysis is on-going.

The figure above shows the positions along the Rosetta flight path of 27 dust grains (red dots) detected by GIADA in August 2014. Five grains (yellow dots) were detected by both the Grain Detection System and the Impact Sensor. Some of the data points overlap or are hidden behind the yellow symbols.
SCIENCE WITH THE LANDER – WHAT TO EXPECT WHEN PHILAE MEETS 67P

When Rosetta's Philae lander touches down on comet 67P/Churyumov-Gerasimenko in two months time, a new chapter will begin for the mission. At the European Planetary Science Congress this week, participants heard from the lander team about the science plans.

Rosetta’s orbiter instruments are producing their first preliminary scientific results and many of these were presented at the European Planetary Science Congress (EPSC) that took place this week in Lisbon, Portugal. While scientists are eagerly examining the data and making the first steps towards characterising comet 67P/C-G, there is also something else on their mind: the selection of the primary landing site and the prospect of the science that can be done when Philae is safely settled on the comet.

The approximate locations of the five candidate landing sites are marked on these OSIRIS narrow-angle camera images taken on 16 August from a distance of about 100 km. Credits: ESA/Rosetta/MPS for OSIRIS Team MPS/UPD/LAM/IAA/SSO/INTA/UPM/DASP/IDA.

During the Rosetta Special Session at EPSC, the lander science team explained the landing site selection process that began almost as soon as Rosetta arrived at the comet in August, and that will conclude in mid-October with the formal Go for landing from ESA. They emphasised the important role played by the orbiter instruments, in particular ALICE, MIRO, OSIRIS, ROSINA and VIRTIS, in identifying suitable candidate landing sites. Philae will get a chance to repay the compliment when on the comet surface, by providing ground-truth measurements for the orbiter instruments.

This weekend, the primary landing site will be selected from the shortlist of five candidates. The team explained that the landing will be a passive one, meaning that the exact location of landing will be determined by the relative position of Rosetta and the comet at the time of Philae’s deployment, and the speed and direction of the deployment: there is no active steering down onto the surface.

As all of these parameters have uncertainties associated with them, the Rosetta and Philae operations teams can only predict the landing point in advance to within an ellipse typically 1 kilometre long on the surface of 67P/C-G. This is larger than any of the apparently smooth terrains on the reachable parts of the surface of the nucleus, adding to the challenge of selecting the best possible site.

As soon as Philae is released from the orbiter, the lander’s first science will begin. This is called the...
separation, descent, and landing (SDL) phase and it will last about 5 to 10 hours – the duration will depend on which landing site is selected and what trajectory needs to be flown to deliver the lander.

During the SDL phase, many of the lander instruments will be active. During the separation and descent of Philae:

- CIVA will make a ‘Farewell’ image of the orbiter;
- ROLIS will take images during the descent;
- COSAC and PTOLEMY will sample the ‘atmosphere’ of the comet as the lander approaches the surface;
- ROMAP will measure the interaction between the solar wind and the cometary plasma;
- SESAME/DIM and SESAME/PP will measure the dust and the plasma environment, respectively;
- CONSERT, along with other experiments on the orbiter and the lander, will measure the rate of descent and, at the same time, will sense the uppermost surface layers of the comet nucleus.

Immediately upon landing:

- CIVA will make a panoramic image of the landing site; this will be used together with other information from the lander to determine where and how Philae has landed.
- MUPUS will measure the deceleration of the harpoons as they are fired to anchor Philae to the surface;
- SESAME/CASSE will measure the elastic properties of the surface.

With Philae safely on the surface, another series of measurements will begin, marking the start of the so-called first science sequence (FSS). This phase will last for a maximum of 54 hours, and the main goal of this phase is to secure a set of the most important scientific measurements at the surface of the comet. The FSS is split into several blocks with distinct science goals.

For the first several hours, a pre-programmed automated sequence of measurements is made. At this stage:

- ROLIS will take images of the surface with micrometre resolution;
- ROMAP will measure the magnetic and plasma properties of the surface environment;
- MUPUS will measure the surface and subsurface temperature at the landing site;
• CONERT will begin operations to probe the comet interior through one complete revolution of the nucleus.

While this automated sequence is running, the lander operators will determine how Philae is oriented by examining the telemetry data for the solar panels - the power distribution of the panels will let them work out the position of the Sun with respect to Philae and thus Philae's orientation. They can also compare the panoramic image of the horizon taken by CIVA-P with images of the surface mapped onto digital terrain models. By the time the automated sequence is completed, the lander operators will know how Philae is oriented and can command the lander to rotate to put it in the best position to illuminate the solar panels – this is crucial to ensure that the batteries can be charged as efficiently as possible.

The next sequence of measurements during the FSS is mainly dedicated to investigating the composition of the subsurface, thus the most pristine constituents. During this period, SD2 will drill into the comet surface to take a sample of a few cubic millimetres of material from beneath the surface. While SD2 drills, COSAC and PTOLEMY will sense the release of gases in the surroundings. SD2 will drill twice during this block, with each sample being further heated in an oven to release chemical species that do not otherwise sublimate from solid state.

The first sample goes to PTOLEMY to measure how much carbon, hydrogen, oxygen and nitrogen there is, and to identify their isotopic composition, while the second sample goes to COSAC to identify and characterise the heavier molecular compounds. Measurements of the dust in the environment will be made with SESAME.

This is followed by some experiments to study the surface properties. The MUPUS hammer is released and embeds itself into the ground so that it can measure the temperature at various depths in the subsurface. The acoustic signals of the vibrations of the hammer action will be detected by acoustic sensors in the feet of SESAME/CASSE and will be used to measure the mechanical properties of the nucleus. APXS will be deployed to measure the elemental composition of the surface material. SESAME/DIM will investigate dust impacts further, and the dielectric properties of the ground will be measured by SESAME/IPP, which can provide some indications about the presence of water ice beneath the surface.

In the next block of measurements, another drill sample will be taken by SD2 and delivered to an oven in which CIVA-M will acquire microscopic images of the samples, both in the visible and in the infrared, to infer its composition. The sample will then be analysed with COSAC at lower oven temperatures than before.

Power and battery recharging permitting, there is the prospect of continuing science operations on the comet surface for the long-term science (LTS) phase, which could run from November until March 2015. The emphasis during this period will be on studying how the conditions and environment at the landing site change as the comet gets closer to the Sun, and to make some additional studies that are among the more challenging of Philae's science goals. These include searching for comet quakes with SESAME, using COSAC to look for evidence of amino acids in a drilled sample, and making tomographic measurements with CONERT, by transmitting radio signals between Philae and Rosetta through different parts of the interior of the comet to look for heterogeneity on smaller scales.

However, it is expected that by March 2015, the temperatures of the compartments on the lander will have reached levels that are too high for Philae to continue operating, and the lander's science mission will come to an end.
Gianfranco D'Elia says: 13/09/2014 at 14:04
Superb Philae, Superb Mission!

Dertutenaix says: 13/09/2014 at 14:31
There are quite a few systems in the lander to assure that it stays put ones it makes contact to the surface. What is a bit worrying is that if the surface is very dusty and soft the feet seam to be very small to prevent is from sinking deep. It lands with a bit under a meter per second but the mass is 100 kg and the inertia is always the same no matter what the gravity is. Why no downward oriented thrusters to make it slow down? Afraid of getting covered in a dust cloud?

emily says: 13/09/2014 at 16:39
See the animation at 0:41 for the downward thruster!

Dertutenaix says: 14/09/2014 at 14:13
Dear Emily in the animation i see the comment thruster pushing down, upward pointing. What i meant is downward pointing thruster breaking the speed of impact. I see none of those. The only break i know of is the electromechanical suspension and the flexibility of the legs. If 100 kg falls with 0.8 m/s on earth or the comet the impact energy is the same, i know this is tested prior to launch on a bed if sand on earth but the risk that it will sink in a bit more on the comet is major as its surface density is at least 10 times less then sand. This is only a guess but so far that is all we can do, make qualified guessing.

Hannes says: 13/09/2014 at 14:43
This last sentence is so sad, I have tears in my eyes.... “However, it is expected that by March 2015, the temperatures of the compartments on the lander will have reached levels that are too high for Philae to continue operating, and the lander's science mission will come to an end.”
> MIRO BATHES IN WATER VAPOUR

Rosetta's MIRO instrument has detected an increase in the rate of water vapour coming from comet 67P/Churyumov-Gerasimenko over the past three months. This was reported by the MIRO team at the European Planetary Science Congress last week.

MIRO first detected water vapour from the coma of comet 67P/C-G in June this year, when Rosetta was 350,000 km from the comet nucleus. At that distance, the nucleus was unresolved and the entire coma filled MIRO's field of view. Now that Rosetta has rendezvoused with the comet, MIRO has begun observations to map the nucleus and coma in great detail.

During the Rosetta Special Session at the EPSC meeting, the MIRO team reported measurements made during the past three months that show that the amount of water vapour coming from the comet appears to vary as the nucleus rotates. They have measured a maximum rate of about 5 litres per second being lost by the comet, with an average rate of roughly 1 litre per second. This is markedly more than the comparatively modest rate of 300 millilitres per second measured in June.

Theoretical models predict that most of the water in the comet's coma should exist over the sunlit side of the nucleus. Rosetta has mostly been flying over the sunlit side to date, and MIRO's measurements are consistent with these predictions. But when Rosetta makes a flight over the night side of the comet later this month, MIRO will have the chance to directly measure the water production rate there.

In addition to water, the MIRO team have also detected ammonia and methanol, but somewhat to their surprise, they have yet to find evidence for carbon monoxide.

MIRO is also able to probe the temperature below the surface of the comet's nucleus. At this stage, MIRO has measured subsurface temperatures between a maximum of 160 K and down to below 30 K. The coldest temperatures are associated with regions on the comet that are in darkness – the night side, areas on the sunlit side where shadows are produced by the local landscape, or in polar regions which have been in darkness for a few years.

The MIRO team estimates that they are probing a few centimetres beneath the surface or deeper. At a later stage, MIRO subsurface temperatures and VIRTIS surface temperatures will be combined to refine this estimate. With these measurements in hand, they will be able to calculate the temperature gradient in the nucleus, providing indications of the material that lies beneath the surface.
Dave says: 15/09/2014 at 14:18
Should we expect subliming ice on the dark side? Where would the heat come from?

Reply

Jason Rowberg says: 15/09/2014 at 21:43
Perhaps stored heat energy in the non-water comet surface materials would cause sublimation after dark, similar to the steam from hot asphalt after an evening rain?

Reply

Alter schwede says: 15/09/2014 at 19:22
Sliters per second peak and 1 liter per second average tells me a lot but for the rest of the audience it would be fair to say how this water vapor is spread out over the giant volume of the tail with a figure of its highest density or equivalent pressure measured in nano bar.

Reply

morganism says: 15/09/2014 at 21:40
Are we measuring hydroxyl, or water stretching bands?
A lot of the jets imaged by the Epoxi mission were coming out of shaded areas.
http://epoxi.umd.edu/

Reply

logan says: 15/09/2014 at 23:10
So atmospheric heat transfer is negligible.

Reply

logan says: 15/09/2014 at 23:20
What I saw at: