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67P/Churyumov-Gerasimenko: Activity between March and July 2014 as observed from Rosetta/OSIRIS

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Abstract

We present results about the early activity of 67P/Churyumov-Gerasimenko (67P) and its evolution with heliocentric distance between approximately 4.3 AU to 3.7 AU inbound, based on OSIRIS images. 67P/Churyumov-Gerasimenko is the target comet of the ESA's Rosetta mission. Launched in 2004, the Rosetta spacecraft woke up on the 20th of January 2014 after 30 months of deep space hibernation, it is now traveling to rendezvous with the comet at 4.1 AU from the Sun, and it will follow 67P along its orbit, investigating how the comet changes and evolves while approaching the Sun. The Optical, Spectroscopic, and Infrared Remote Imaging System, OSIRIS [1], is the camera system onboard Rosetta. It comprises a Narrow Angle Camera (NAC) with a wavelength range 250 - 1000 nm and a Wide Angle Camera (WAC) with wavelength range 240 - 720 nm. The NAC (FOV = $2.20^o \times 2.22^o$) is a system with high spatial resolution that allows an initial detection of the nucleus, studies its structure and rotation from relatively great distances, investigates the mineralogy of its surface, and studies the dust ejection processes. The WAC has spatial resolution $\sim$ 5 times lower than the NAC but, accordingly, a much wider field of view (about $11.35^o \times 12.11^o$). This allows observations of the 3-dimensional flow-field of dust and gas near the nucleus and, in addition, provides a synoptic view of the whole nucleus. In summary, the WAC would provide long-term monitoring of the entire nucleus from close distances, while the NAC studies the details. The two camera units have been designed as a complementary pair, which, on the one hand, addresses the study of the nucleus surface, and on the other, investigates the dynamics of the sublimation process. After commissioning at the end of March 2014, OSIRIS began imaging 67P and its dust environment. Ground-based observations performed in 2007/08 when the comet was in the same orbital arc as it was in March-April 2014, show that 67P was already active at 4.3 AU inbound and that its behavior was repetitive during the last three apparitions [2]. We therefore expected to detect early cometary activity with OSIRIS already in the first images. Rosetta is approaching the comet from about 4 million kilometers in March 2014 to 20000 kilometers at the beginning of July 2014, when the nucleus of 67P will start to be resolved (a few pixels in diameter) in the OSIRIS/NAC images. The comet nucleus will fill the whole NAC FOV in the middle of August 2014, as the comet-spacecraft distance will shorten. We present results about the early cometary activity and its evolution with heliocentric distance, based on OSIRIS images. We focus on the images of 67P acquired by OSIRIS between March and July 2014 when the comet nucleus was unresolved and moving from approximately 4.3 AU to 3.7 AU inbound. Orange filter images (central wavelength 649.2 nm) are used to study the dust environment of 67P and its evolution with heliocentric distance, since this wavelength range is quite free from gas emission bands. The gas environment, instead, is studied through imaging in the OI (central wavelength 631.6 nm) and CN (central wavelength 388.4 nm) filters. Preliminary analysis (at the time of abstract submission) shows that the comet is clearly active by eye in the OSIRIS images taken in late April 2014 when the comet was at 4.1 AU. We will also present estimates of the dust production rates and velocities based on the developing coma and tail of the comet.

References

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