

Press Release

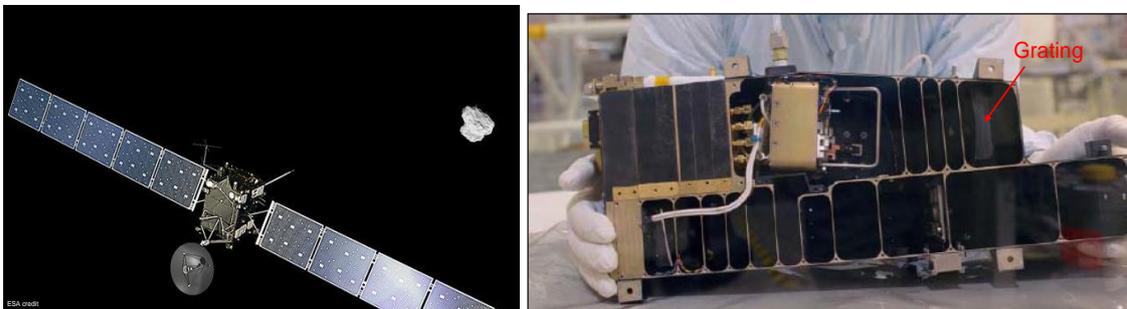
November 2014

HORIBA Jobin Yvon grating in ROSETTA mission

ESA's comet-chasing mission Rosetta was launched on the 2nd of March 2004 and through a complex series of flybys (three times past Earth and once past Mars) arrived ten years after at its destination: comet 67P/Churyumov–Gerasimenko. In June 2011, Rosetta was put into deep-space hibernation for the coldest, most distant leg of the journey (800 million kilometres from the sun) and was woken up on 20th of January 2014. Finally, Rosetta was set on comet's orbit on August 2014 to achieve a successful landing of Philae lander on 12th of November 2014.

Comets are the primitive building blocks of the Solar System and the likely source of many elements such as water and perhaps the ingredients that helped life evolve. By studying the nature of a comet close up with an orbiter and a lander, Rosetta will show us more about the role of comets in the evolution of the Solar System.

Rosetta orbiter consists in 11 state-of-the-art instruments. Among these 11 instruments, **the Ultraviolet Imaging Spectrometer – ALICE instrument is equipped with a HORIBA Jobin Yvon diffraction grating**. ALICE is a lightweight (2.2 kg), low power (2.9 W) imaging spectrograph optimized for cometary far-ultraviolet (FUV) spectroscopy. With a spectral range from 70 to 205 nm, ALICE role is to make measurements of noble gas abundances and atomic budget in the coma, and major ion abundances in the tail and in the region where solar wind particles interact with the ionosphere of the comet. ALICE determines the production rates, variability, and structure of H₂O, CO, and CO₂ gas surrounding the nucleus and the FUV properties of solid grains in the coma. **ALICE began mapping the comet's surface last August, recording the first FUV light spectra of the comet's surface**. From the data, the Alice team discovered the comet is unusually dark when viewed in UV wavelengths. ALICE also detected both hydrogen and oxygen in the comet's coma, or atmosphere.



(Left image) Artist view of Rosetta approaching the comet 67P/Churyumov–Gerasimenko. (Image credit: ESA)

(Right image) Picture of ALICE instrument with the installed diffraction grating [1].

The key optical component of the ALICE instrument is the toroidal holographic replica diffraction grating manufactured by HORIBA Jobin Yvon in 1999. The development of this grating batch was

the result of a fruitful collaboration between the Southwest Research Institute (SWRI – USA), and HORIBA Jobin Yvon's team.

The ALICE diffraction grating, with a groove density of **1600 gr/mm, made on a metallic material substrate to minimize the weight**, was optimized to work in a Rowland Circle type imaging spectrograph. Thanks to the **holographic recording and space-qualified (TRL 9) replication process**, the ALICE grating exhibited **low stray light and no ghost**. The grating active area is 35 mm in the dispersion direction by 20 mm in the spatial dimension. The spectrograph uses the first diffraction order through the full spectral bandpass 70 nm – 205 nm. **The spectral resolution was measured between 0.98 and 1.25 nm with a spectral resolving power of 55-200.**

After more than 15 years of life, with more than 10 years of operation in a space environment during the Rosetta journey, the ALICE holographic replica grating has kept its initial high performance and continues to bring to the scientific community extraordinary discoveries.

This successful common design of the spectrograph and the grating was re-used for other space-flight missions such as LAMP, Juno-UVS, ...

HORIBA Jobin Yvon S.A.S. company, part of HORIBA Scientific (HORIBA Group), is a world leading supplier of spectroscopy, analytical instruments and diffractive optics for research and industry. HORIBA Jobin Yvon has been selected and has participated in a large number of NASA or ESA space-flight missions by developing very high performance diffraction gratings for spectrographs. HORIBA Jobin Yvon designs, manufactures and tests a large range of scientific diffraction gratings for Lasers, Space flight and Synchrotron applications.

[1] S. A. Stern *et al*, "ALICE : The ROSETTA Ultraviolet Imaging Spectrograph", The Rosetta Mission – Space Science Review (2005).

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