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Inferring the properties of ice on comet 67P/Churyumov-Gerasimenko from the Microwave Instrument on the Rosetta Orbiter (MIRO)

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ESA's Rosetta spacecraft just arrived at comet 67P/Churyumov-Gerasimenko. Since the approach in June 2014, the MIRO instrument has been acquiring two types of data: continuum emission thermal data from the nucleus at the two operating wavelengths of 190 and 562 GHz, and spectroscopic data at 562 GHz on the gas present in the coma. The two continuum channels allow for probing the temperature in the shallow subsurface over two effective depths on the order of a few millimeters to a few centimeters. The submillimeter spectrometer is sensitive to the gas molecules (H_2O including oxygen isotopologues, CO, NH3, CH3OH) emitted by the nucleus.
The location of the ices that are at the source of the gases found in the coma is still poorly constrained, as well as their state: pure condensate ices, hydrates, or gas entrapped in amorphous ice. Icy grains emitting water vapor have been observed in the inner coma of comet 103P/ Hartley 2 by the EPOXI mission. Such icy grains need to be lifted off the nucleus by pre-existing gas, thus they may only represent a secondary source of the gas present in the coma even if observed on 67P/Churyumov-Gerasimenko.
We will compare the results obtained on the thermal emission of the nucleus and on the composition of the inner coma, particularly at the local/regional scale, with the phase diagrams and sublimation/dissociation rates of the various types of ices, in order to assess the location and composition of the ices in the source region(s) within the 67P/Churyumov-Gerasimenko nucleus.

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