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In-situ investigations of the ionosphere of comet 67P

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Abstract

Since arrival of Rosetta at its target comet 67P/Churyumov-Gerasimenko in August 2014, the plasma environment has been dominated by ionized gas emanating from the comet nucleus rather than by solar wind plasma. This was evident early on from the strong modulation seen with Rosetta's position in a reference frame fixed to the rotating nucleus, with higher plasma densities observed when the spacecraft is above the neck region and when the comet exposes maximum area to the sun. In this respect, Rosetta is inside the comet ionosphere, providing excellent in situ investigation opportunities for the instruments of the Rosetta Plasma Consortium (RPC). In contrast to the often modelled scenario for a very active comet, the Langmuir probe instrument (RPC-LAP) finds electron temperatures mainly in the range of tens of thousand kelvin around this less active comet. This can be attributed to the lower density of neutral gas, meaning little cooling of recently produced electrons. A side effect of this is that the spacecraft charges negatively when within about 100 km from the nucleus. Interesting in itself, this also may point to similar charging for dust grains in the coma, with implications for the detection of the smallest particles and possibly for processes like electrostatic fragmentation. The inner coma also proves to be very dynamic, with large variations not only with latitude and longitude in a comet frame, but also with the solar wind and various wave phenomena.