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Spatial distribution of low energy plasma at comet 67P from Rosetta RPC-LAP measurements

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We present in situ measurements of the low energy plasma environment around comet 67P from the two Langmuir probes (LAP) on the Rosetta spacecraft, which form part of the Rosetta plasma consortium (RPC). RPC-LAP has operated almost continuously as Rosetta has orbited the comet at close distance (10-30 km) at low velocity (about 1 m/s) since August 2014. Using the RPC-LAP measurements we have produced global maps of the low energy plasma in the vicinity of 67P. Initial estimates indicate that the plasma density has reached values of several 100 cm$\hat{}$-3 and that the electron temperature has typically been in the range 5-10 eV, when the comet was beyond 2.5 AU from the sun. Photoionisation is the dominating process for producing the plasma around the comet while charge-exchange and impact ionisation may also contribute. The plasma environment has been found to be strongly coupled to the local neutral gas density, which in turn is coupled to which area on the comet is facing the sun. The northern summer neck-area of the comet outgasses more than other areas and above this region are the highest densities observed. In the southern winter and above the two main lobes of the comet body, the plasma density is lower. The plasma density is hence not determined by the solar wind, but by the outgassing from the comet. The 12.4-hour rotation period of the comet together with the varying latitude of the slow-moving Rosetta provide strong modulation of the RPC-LAP measurements. Besides orbiting the comet, Rosetta will also perform flybys of the comet in early 2015 when Rosetta will move to distances of several hundred kilometres from the nucleus. These flybys provide a cut-through view of the near-comet plasma environment, which will possibly give some insight to the solar-wind interaction with the cometary coma.