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Observations of mixed warm and cold electrons with RPC-MIP at comet 67P/Churyumov-Gerasimenko

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Abstract

In the ionosphere of the comet 67P/Churyumov-Gerasimenko, the Rosetta Plasma Consortium (RPC) instruments measured the plasma environment during more than two years from August 2014 to September 2016. The Ion Electron Sensor (RPC-IES) and the Langmuir Probes (RPC-LAP) reported different electron populations: (i) a suprathermal electron component (40-100 eV), (ii) a warm electron component of cometary origin (5-10 eV) and (iii) a cold component (<1 eV) of electrons thermalized by collisions with neutrals.

The Mutual Impedance Probe (RPC-MIP) has been operated to measure the total electron density. Gilet et al. [1] simulated the mutual impedance response for a probe immerged in a two-electron temperature plasma, with both cold and warm component were modelled by a Maxwellian distributions.

Through a direct comparison between simulated and observed mutual impedance spectra, the density and the temperature of the two electron populations have been retrieved for Rosetta data. This study focuses on three events: (i) on 2015 November 1 in the magnetized cometary plasma near perihelion (1.4 AU), (ii) inside a diamagnetic (unmagnetized) region on 2015 November 20, still near perihelion, and (iii) far from perihelion (3.2 AU) on 2016 May 23.

We illustrate the dynamics of the cold and warm electron populations and that the cold electrons can be transported along the magnetic field far from the electron-neutral collision region where the electrons are expected to have cooled down.

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References

[1] Gilet, N., Henri, P., Wattieaux, G., Cilibrasi, M., & Béghin, C. (2017). Electrostatic potential radiated by a pulsating charge in a two-electron temperature plasma. *Radio Science*, 52, 1432–1448.

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