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Rosetta spacecraft potential and electron temperature in the coma of comet 67P

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We present and compare measurements of the spacecraft potential ($V_{S/C}$) of ESA's Rosetta spacecraft during its ~ 2 year stay in the inner coma of comet 67P/Churyumov-Gerasimenko, by the Rosetta Langmuir probe (RPC-LAP) and Ion Composition Analyzer (RPC-ICA) instruments. $V_{S/C}$ was mostly negative, driven so by the high (~ 5 - 10 eV) electron temperature of the coma photoelectrons. LAP only picks up a portion of the full $V_{S/C}$ since the two probes, mounted on booms of length 2.2 and 1.6 m, respectively, are generally inside the potential field of the negatively charged spacecraft. Comparison of the minimum energy of positive ions collected by ICA shows that this portion varies between 0.7 and 1 $V_{S/C}$, with generally good correspondence between the two instruments except when local ion production is weak and accelerated ions dominate the flux. We map $V_{S/C}$ and its evolution during the mission and use it to constrain the electron density n_e and temperature T_e in the inner coma. Comparison of $V_{S/C}$ measurements to electron density measurements by the Mutual Impedance Probe (RPC-MIP) allows more accurate estimates of the electron temperature and a cross-calibration of the n_e and T_e measurements by the different instruments.