



Spacecraft and dust grain charging at comet 67P: observations and modeling

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The electrostatic potential of a dust grain and a spacecraft is set by the same balance between electric currents flowing between the object and surrounding space. We present data from the Rosetta Plasma Consortium (RPC) to show that starting at its arrival in the close vicinity of comet 67P/Churyumov-Gerasimenko in September, the Rosetta spacecraft mostly is at a negative potential with respect to surrounding space, with typical magnitude of a few tens of volts. Using simple theory and simulations with the SPIS code package, this rather highly negative spacecraft potential is interpreted as due to high electron temperature in the freshly ionized plasma, as the density of the gas emitted by the comet is too low to cause significant collisional cooling of photoelectrons in the early stages of comet activity. To first approximation, dust grains will charge about equally as the spacecraft. Hence dust can also be expected to reach negative potentials up to tens of volts, with implications for grain detection and evolution.