

## **Keeping Cool in a Hot Place: Cold Electrons at Comet 67P**

A. I. Eriksson (1), I. A. D. Engelhardt (1,2), E. Odelstad (1,2), E. Vigren (1), F. L. Johansson (1,2), P. Henri (3), N. Gilet (3)

(1) Swedish Institute of Space Physics, Uppsala, Sweden

(2) Department of Physics and Astronomy, Uppsala University, Sweden

(3) LPC2E, CNRS, Université d'Orléans, France

Cometary electrons are born at typical energies of order 10 eV, but can cool to the temperature of the surrounding neutral gas (a few hundred K) by collisions. As the cooling rate depends on the gas density, low activity comets can be expected to show less of electron cooling. In situ observations by Rosetta show that the electron flux at the position of the spacecraft was dominated by a warm population ( $\sim 10$  eV) throughout the mission. Nevertheless, we show that cold electrons ( $< 0.3$  eV) were intermittently observed by Rosetta through large parts of the mission, commonly around perihelion but occasionally as far as 3 AU. The measurement technique combines the data from two Rosetta plasma instruments, the Langmuir probe LAP and the Mutual Impedance Probe MIP. We compare the observations to simple theoretical expectations and suggest how the cooling can be more efficient than simple considerations may suggest.