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Photoelectrons and spacecraft potential effects on SWA-EAS electron measurements on board the Solar Orbiter spacecraft

Stepan Stverak[1,2], David Herčík[1], Petr Hellinger[2,1], Georgios Nicolaou[3], Christopher Owen[3], and Milan Maksimovic[4]

[1]Institute of Atmospheric Physics, CAS, Group of Numerical Simulations of Heliospheric Plasmas, Prague, Czechia
[2]Astronomical Institute, CAS, Prague, Czechia
[3]Mullard Space Science Laboratory, University College London, Holmbury St. Mary, Dorking, UK
[4]LESIA, Observatory Paris, Meudon, France

Any spacecraft immersed into the solar wind builds up a non-zero electric potential with respect to the local environment by continuously collecting the charged particles from ambient plasma populations and emitting additional charged particle populations, namely photo-electrons and/or secondary electrons, from its surface materials. These newborn electrons of spacecraft origin as well as the electric fields induced in the vicinity of the spacecraft body by the so called spacecraft potential may in turn significantly distort the local plasma conditions and therefore affect any in-situ electron observations and thus potentially modify the derived electron properties. Here we present an observational analysis of these effects as seen by the SWA-EAS electron analyser in the variable plasma and electrostatic environment of the Solar Orbiter spacecraft. We provide some characteristic properties of these parasitic electron populations in order to later develop possible correction methods applied to the SWA-EAS measurements for deriving unperturbed ambient plasma properties. The analysis is performed on a statistical basis using a large set of SWA-EAS 3D electron velocity distribution functions and in comparison to other relevant in-situ measurements acquired namely by other two complementary on board plasma instruments – SWA-PAS and RPW.