Large-scale electron solar wind parameters of the inner heliosphere with Parker Solar Probe/FIELDS

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We present in situ properties of electron density and temperature in the inner heliosphere obtained during the three first solar encounters at 35 solar radii of the Parker Solar Probe mission. These preliminary results, recently shown by Moncuquet et al., ApJS, 2020, are obtained from the analysis of the plasma quasi-thermal noise (QTN) spectrum measured by the radio RFS/FIELDS instrument along the trajectories extending between 0.5 and 0.17 UA from the Sun, revealing different states of the emerging solar wind, five months apart. The temperature of the weakly collisional core population varies radially with a power law index of about -0.8, much slower than adiabatic, whereas the temperature of the supra-thermal population exhibits a much flatter radial variation, as expected from its nearly collisionless state. These measured temperatures are close to extrapolations towards the Sun of Helios measurements.

We also present a statistical study from these in situ electron solar wind parameters, deduced by QTN spectroscopy, and compare the data to other onboard measurements. In addition, we focus on the large-scale solar wind properties. In particular, from the invariance of the energy flux, a direct relation between the solar wind speed and its density can be deduced, as we have already obtained based on Wind continuous in situ measurements (Le Chat et al., Solar Phys., 2012). We study this anti-correlation during the three first solar encounters of PSP.