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Non-thermal electron distribution functions through 3D magnetic reconnection instabilities in the solar wind

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The effects of kinetic instabilities on the solar wind electron velocity distribution functions (eVDFs) are mostly well understood under local homogeneous and stationary conditions. But the solar wind also contains current sheets, which affect the local properties of instabilities, turbulence and thus the observed non-maxwellian features in the eVDFs. Those processes are vastly unexplored. Therefore, we aim to investigate the influence of self-consistently generated turbulence via electron-scale instabilities in reconnecting current sheets on the formation of suprathermal features in the eVDFs. For this sake, we carry out 3D fully-kinetic Particle-in-Cell code numerical simulations of force free current sheets with a guide magnetic field. We find extended tails, anisotropic plateaus and non-gyrotropic features in the eVDFs, correlated with the locations and time where micro-turbulence is enhanced in the current sheet due to current-aligned streaming instabilities. We also discuss the influence of the plasma parameters, such as the ion to electron temperature ratio, on the excitation of current sheet instabilities and their effect on the properties of the eVDFs.