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Breakdown of electrons adiabaticity through a nonstationary front of a perpendicular collisonless shock

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Test particle simulations are performed in order to analyze in details the dynamics of transmitted electrons through a supercritical strictly perpendicular (stationary) collisionless shock. Recent analysis (Savoini et al., Ann. Geophy., 2005) has evidenced three electron populations: (i) adiabatic, (ii) over-adiabatic characterized by an increase of the gyrating velocity higher than that expected from the conservation of the magnetic moment and (iii) under-adiabatic characterized by a decrease of this velocity and not predicted by any existing theory. Criteria specific to each population have been clearly identified. Presently, this work is extended by investigating the impact on the intrinsic nonstationarity of a 2-D shock front, revealed by the self-reformation along the shock normal, and the shock front rippling. Analysis of individual time particle trajectories is performed and completed by statistics based on different upstream distributions (spherical shell and Maxwellian). All combined nonstationary and nonuniformity effects have a filtering impact leading to a main and compensative variation in the relative percentages of adiabatic and over-adiabatic populations, in contrast with under-adiabatic population which is relatively poorly affected.