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Energization mechanisms of backstreaming electrons within the foreshock region: 2-D full-particle simulation results.

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Upstream of the terrestrial bow shock, the foreshock region is characterized by beams of particles backstreaming into the solar wind and by an important associated wave activity . In this work, results issued from two dimensional PIC simulation of a curved shock are presented, where full curvature effects of a quasi perpendicular shock and both electrons and ions dynamics are fully described by a self consistent approach. The present study is restricted to the angular range $90^\circ \leq \theta_{Bn} \leq 45^\circ$, where$\theta_{Bn}$ is the angle between the shock normal and the upstream magnetostatic field. Herein the attention is mainly focussed on the electron foreshock region and the electron dynamics within this region. This study is en extension of a previous statistical work (Savoini and Lembege, 2002). Present simulations clearly show that the oversimplified picture of the fast-Fermi acceleration process (type 1) as an unique source of the backstreaming electron energization is incomplete and should be strongly revised. Preliminary results evidence that three different classes of electrons contribute to the backstreaming population, depending on their interaction with the shock front: (i) the "expected" mirrored reflected electrons (Fermi type 1) in the shock front, (ii) the resonant population trapped within the parallel electrostatic potential well in the overshoot region and which gains enough energy to escape back into the upstream region and (iii) the "leaked" electrons which penetrate more deeply into the downstream region and are also locally accelerated before finding appropriate conditions at the shock front to escape back into the upstream region. These three classes are analysed in details and respective acceleration conditions are presented.