# 2-D full-particle simulation of electron foreshock within the quasiperpendicular shock region : identification of the different backstreaming electrons populations

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## Abstract

The foreshock region located upstream of the terrestrial bow shock is characterized by beams of particles backstreaming into the solar wind and by an important associated wave activity . The purpose of the present work is to identify the different sources of backstreaming electrons. This work is based on the use of two dimensional PIC simulation of a curved shock, where full curvature effects of a quasi perpendicular shock and both electrons and ions dynamics are fully described by a self consistent approach. Curvature effects are restricted with the angular range $90° \leq \Theta_{Bn} \leq 45°$, where $\Theta_{Bn}$ is the angle between the shock normal and the upstream magnetostatic field). In extension to a previous statistical work [1], 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 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 reaching appropriate conditions at the shock front to escape back into the upstream region. Details on their acceleration mechanisms will be presented.

## References

1 P. Savoini and B. Lembege, "Two-dimensional simulations of a curved shock: Self-consistent formation of the electron foreshock", *J. Geophys. Res.*, **106**, 2001, pp. 12975-12992.