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Structure of a termination shock: Parameter survey

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Structure of a termination shock is investigated by utilizing one-dimensional full particle-in-cell simulation. Parameter dependence of the shock structure on solar wind plasma beta, distribution function of the pickup ions, Alfven Mach number, ion-to-electron mass ratio, and electron plasma to cyclotron frequency ratio is discussed, while a relative pickup ion density and shock angle are fixed to 30% and 87 deg., respectively. When the solar wind plasma beta is low (=0.17), modified two-stream instability (MTSI) gets excited in the extended foot sustained by reflected pickup ions and both solar wind electrons and ions are heated. If the solar wind plasma beta gets five times higher (=0.85), on the other hand, the MTSI is weakened and the pre-heating of the solar wind plasma in the extended foot is suppressed. When the distribution function of the upstream pickup ions are given by Maxwellian, instead of a spherical shell, the size of the extended foot becomes larger and heating of downstream solar wind ions is less efficient. If the Alfven Mach number becomes high (=28), a self-reformation of the shock front occurs. This results in a wiggled structure of the downstream solar wind ions, but the reformation seems not to contribute to strong acceleration of pickup ions.

Keywords: termination shock, pickup ion