高ベータ低マッハ数準垂直衝撃波における高エネルギー電子の生成

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Electron energization in high beta low Mach number quasi-perpendicular shock

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We investigate the roles of electron shock drift acceleration in a high beta and low Mach number quasi-perpendicular shock which is commonly present in a variety of circumstances in space such as pickup ion mediated heliospheric termination shock, cosmic ray modified sub-shcok of a supernova remnant shock, galaxy cluster merger shock, etc. We previously showed that some of the upstream incident thermal electrons are accelerated through the mechanism called shock drift acceleration and reflected back toward upstream. For appropriate parameters, accelerated electrons can have relativistic energy after the reflection. However, the region of parameter space where the mechanism works is limited. Here, we examine the possibility that a high beta and low Mach number shock can preferentially accelerate the particles having already non-thermal energies which are preaccelerated through some unknown mechanisms. We perform two-dimensional full particle-in-cell simulation of a high beta and low Mach number quasi-perpendicular shock. In addition to the self-consistent plasma electrons and ions, test electrons whose temperature is one order higher than background upstream self-consistent electrons are introduced. We assume that these halo electrons are sufficiently tenuous so that they do not affect electromagnetic fields. We found that the halo electrons are well energized, even though background self-consistent electrons are not. Mechanism and efficiency of energization of the halo electrons are discussed.