Suppression of shock front re-formation process at strong shock waves

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The dynamics of the perpendicular shock front is examined under various plasma parameters by using particle-in-cell numerical simulation. As widely accepted, above the critical Mach number (about 3) the front of (quasi-)perpendicular shock as well as (quasi-)parallel shocks show nonstationary cyclic behavior (shock re-formation). In higher Mach number regime (MA is greater than about 30), we find that a shock front propagates smoothly and continuously, namely, quasi-stationary again. Because of rapid, strong electron thermalization in the shock transition region, electrons tend to play an important role in the stabilization of the shock front dynamics. We focus on the pressure dynamics; when magnetic pressure is dominant as in low mach number regime, a shock propagates in a stationary manner. When ion and electron pressures become comparable to the magnetic pressure, a shock behaves dynamically and shock front re-formation is observed clearly. When the ion and electron pressures are dominant as observed in high Mach number regime, a shock propagates in a quasi-stationary manner. The structure and dynamics of the electromagnetic fields as well as particles in the shock transition region will be discussed in detail.