

## Characteristics of quasi-perpendicular shocks accompanied by modified two-stream instability

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Modified two-stream instability (MTSI) is thought to be generated in the foot of high Mach number quasi-perpendicular shocks at 1AU. Our past studies using one and two dimensional PIC (particle-in-cell) simulations, however, are case study analyses with limited parameter regime. In this study, characteristics of shock system involving MTSI are investigated by reproducing long time evolution of shock waves with various upstream plasma parameters. Wave characteristics, particle distribution functions, influences of MTSI on self-reformation process of the shock, etc., are examined for a variety of Mach numbers, shock angles, ratios of electron plasma to cyclotron frequencies.