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Irreversible dissipation at collisionless shocks: Nonlinear ion-acoustic instability LI-JEN CHEN, University of Iowa, ABIGAIL RYMER, University College London,UK, WILLIAM KURTH, DONALD GURNETT, University of Iowa — A number of wave instabilities have been proposed to account for irreversible dissipation across collisionless shocks. However, the most dominant instability has not been identified. For example, observations at Earth have not been able to determine the exact wave mode due to overlapping of the corresponding characteristic frequencies. We use Cassini observations at the bow shocks of Saturn and Earth to rule out a majority of previously proposed instabilities and identify the most dominant instability as the nonlinear ion-acoustic instability. Electron distributions at the bow shocks of Earth and Saturn, and interplanetary shocks are shown to have a common flat-topped component. We carry out particle simulations to demonstrate that the nonlinear ion-acoustic instability can produce turbulent wave fields that efficiently heat electrons and produce flat-topped electron distributions. Our observation and simulation results indicate that the nonlinear ion-acoustic instability is the most important contributor to irreversible dissipation across collisionless shocks.

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