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Generation of Suprathermal Ions During Variable Upstream Plasma Conditions and its Effect on the Shock Structure

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A collisionless shock can be considered a self-regulatory system that responds to the solar wind energy input. At the shock, the solar wind kinetic energy is converted into downstream plasma heating, ion reflection and acceleration. Changes in upstream plasma conditions can result in changes in the dynamic of the shock, its structure, and the generated suprathermal ion population. These upstream variations can be due to transients, interplanetary shocks, and other discontinuities. A number of these events can be found in observation from STEREO (for interplanetary traveling shocks) and CLUSTER/MMS (for the Earth's bow shock).
We performed 2D-hybrid simulations to study the effects of spatially confined density enhancements and depletion on shock reformation, energetic particle release, and its associated wave generation at the shock and downstream. It appears that shock reformation is highly impacted by density depressions/enhancements and so is the generation of waves and suprathermal ions. It appears that these upstream solar wind variations can alter the shock properties considerably.