
Hybrid modeling of CR dynamics in collisionless shocks in multispecies plasma

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Abstract

The microphysics of Cosmic Rays injection and acceleration in astrophysical shocks is studied by means of 3d second-order accurate, divergence-conserving hybrid code "Maximus". The code allows treatment of multispecies plasma.

The development of non-thermal power-law ion distribution tails is clearly seen for different sorts of ions. Analyses of individual particle trajectories show that in quasiparallel collisionless shocks a few percent of upstream ions is reflected during the first interaction with shock front and enters the diffusive shock acceleration (DSA) process.

The validity of model is verified on the example of solar wind event. The simulated distributions of protons, helium and oxygen ions are in good agreement with in-situ observations.

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