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Quasilinear simulations of interplanetary shocks and Earth's bow shock

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We have developed a new self-consistent Monte Carlo simulation model for particle acceleration in shocks. The model includes a prescribed large-scale magnetic field and plasma density, temperature and velocity profiles and a self-consistently computed incompressible ULF foreshock under the quasilinear approximation. Unlike previous analytical treatments, our model is time dependent and takes full account of the anisotropic particle distributions and scattering in the wave-particle interaction process. We apply the model to the problem of particle acceleration at traveling interplanetary (IP) shocks and Earth's bow shock and compare the results with hybrid-Vlasov simulations and spacecraft observations. A qualitative agreement in terms of spectral shape of the magnetic fluctuations and the polarization of the unstable mode is found between the models and the observations. We will quantify the differences of the models and explore the region of validity of the quasilinear approach in terms of shock parameters. We will also compare the modeled IP shocks and the bow shock, identifying the similarities and differences in the spectrum of accelerated particles and waves in these scenarios.

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