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Modeling particle acceleration in quasi-perpendicular coronal shock waves

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We present analytical estimates and numerical simulations of particle acceleration in coronal shock waves with quasi-perpendicular geometry. It is well known that the maximum energy of the accelerated particles is limited by the available acceleration time and the scattering conditions prevailing in the shock neighborhood. Numerical simulation code coupling a trajectory integrator operating in the shock vicinity and a guiding-center integrator operating further away from the shock is presented. Scattering conditions necessary for efficient acceleration of protons up to 1–100 MeV energy are evaluated. We compare these conditions with earlier-derived constraints for coronal scattering conditions consistent with the observed arrival of first particles at 1 AU during a solar particle event. The role of perpendicular diffusion in coronal shock acceleration is also discussed.