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Radio radiation and acceleration potential of CME-driven shocks

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CME-driven shocks are effective radio radiation generators and accelerators for Solar Energetic Particles (SEPs). We present simulated 3 D time-dependent radio maps of second order plasma radiation generated by CME-driven shocks. The CME with its shock is simulated with the 3 D BATS-R-US CME model developed at the University of Michigan. The radiation is simulated using a kinetic plasma model that includes shock drift acceleration of electrons and stochastic growth theory of Langmuir waves. We find that in a realistic 3 D environment of magnetic field and solar wind outflow of the Sun the CME-driven shock shows a detailed spatial structure of the density, which is responsible for the fine structure of type II radio bursts. We also show realistic 3 D reconstructions of the magnetic cloud field of the CME, which is accelerated outward by magnetic buoyancy forces in the diverging magnetic field of the Sun. The CME-driven shock is reconstructed by tomography using the maximum jump in the gradient of the entropy. In the vicinity of the shock we determine the Alfven speed of the plasma. This speed profile controls how steep the shock can grow and how stable the shock remains while propagating away from the Sun. Only a steep shock can provide for an effective particle acceleration.