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Simulations of Coronal Type III Solar Radio Bursts

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Numerical predictions are presented for the dynamic spectra of coronal type III bursts observed at Earth, using a newly developed simulation model and employing realistic electron release and coronal parameters. The model incorporates the three-dimensional structure of the source region, the dynamics in the source of electron beam, Langmuir waves, ion-sound waves, and electromagnetic emissions at the fundamental (f_p) and second harmonic ($2f_p$) of the plasma frequency, and the propagation of electromagnetic radiation from the corona to interplanetary space. The spectra are studied in detail, in association with the dynamics of beam and waves in the source. The frequency drift rate, radio flux, brightness temperature, and temporal profile of the type III bursts agree semiquantitatively with typical observations. Due to strong free-free absorption and scattering-induced damping, the flux of f_p emission is significantly lower than that of $2f_p$ emission, and can be below the thresholds of typical radio instruments. For the chosen parameters the electron beam stops producing f_p emission within the simulation domain but produces $2f_p$ emission to the largest altitudes simulated. Fundamental-harmonic pairs may exist under favorable conditions, such as when ambient density has low levels and large length scales of density fluctuations.