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Type II and type III radiation from Langmuir wave eigenmodes

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We formulate a theory for the conversion between localized electrostatic Langmuir waves and the electromagnetic radiation of type II and type III radio bursts based on the idea that Langmuir waves are eigenmodes of solar wind density cavities which radiate as antennas. The authors previously observed that some localized Langmuir waves show concurrent electrostatic oscillations at twice the local plasma frequency (2fp) interpreted as second order driven currents which are capable of radiating at 2fp. Predicted 2fp radiation intensity per wave packet convolved with measured distributions of wave packet field strength and localization scale were used to show that under certain plasma conditions, the antenna radiation mechanism is capable of accounting for a significant portion of the total 2fp radiation from the Earth's foreshock region. We now extend the previous work to fp antenna radiation, a more difficult problem which must account for escape of the radiation from solar wind density cavities and scattering through other local density perturbations. Though it is possible that the eigenmode antenna radiation mechanism can produce a significant fraction of the total electromagnetic intensity from type III and type II radio bursts, the efficiencies of fp and 2fp radiation vary by orders of magnitude depending on solar wind plasma conditions. We present a theoretical study of the plasma conditions under which fp and 2fp eigenmode antenna radiation are efficient and a comparison with STEREO/WAVES and WIND/WAVES data.