Electromagnetic emission via linear mode conversion mediated by stimulated Raman backscattering

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Linear mode conversion (LMC) in plasma is a process where the electrostatic and electromagnetic waves are converted into each other under certain conditions. Here we focus on the conversion Langmuir waves to electromagnetic waves, where the Langmuir waves are excited by stimulated Raman backscattering (SRBS) of incident lasers in underdense inhomogeneous plasma. The evolution of the wave vector of the Langmuir waves excited by SRBS is analyzed and the time when the wave vector approaches zero is estimated. Around this time, mode conversion from Langmuir waves to electromagnetic waves occurs. A series of particle-in-cell simulations has been carried out to confirm this. The effects of laser-plasma parameters on the conversion efficiency, including the laser intensity, the angle of incident laser, the laser pulse duration, the initial electrons temperature, and the plasma density scale length. As SRBS can be driven below the quarter critical density in inhomogeneous plasma, the corresponding Langmuir waves and the electromagnetic emission from the mode conversion can cover a frequency range from zero up to half of the incident laser frequency. This emission may provide a useful diagnosis of SRBS.