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Second Harmonic Generation of Higher-Order Gaussian Laser Beam in Density Rippled Plasma

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Abstract : This work presents the theoretical investigation of an enhanced second-harmonic generation of higher-order Gaussian laser beam in plasma having a density ramp. The mechanism responsible for the self-focusing of a laser beam in plasma is considered to be the relativistic mass variation of plasma electrons under the effect of a highly intense laser beam. Using the moment theory approach and considering the Wentzel-Kramers-Brillouin approximation for the non-linear Schrodinger wave equation, the differential equation is derived, which governs the spot size of the higher-order Gaussian laser beam in plasma. The nonlinearity induced by the laser beam creates the density gradient in the background plasma electrons, which is responsible for the excitation of the electron plasma wave. The large amplitude electron plasma wave interacts with the fundamental beam, which further produces the coherent radiations with double the frequency of the incident beam. The analysis shows the important role of the different modes of higher-order Gaussian laser beam and density ramp on the efficiency of generated harmonics.

Keywords : density rippled plasma, higher order Gaussian laser beam, moment theory approach, second harmonic generation.
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