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Frequency mixing of two Q- Gaussian laser beams in plasma: Effect of cross focusing

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A scheme for second-harmonic generation (SHG) of a pair of q-Gaussian laser beams interacting nonlinearly with underdense plasma has been proposed. Due to the relativistic increase in electron mass under the intense fields of the laser beam, the resulting optical nonlinearity of plasma leads cross-focusing of the laser beams. The resulting nonlinear coupling between the two laser beams makes the oscillations of plasma electrons to contain a frequency component equal to the sum of frequencies of the pump beams. This results in a nonlinear current density at frequency equal to the sum of frequencies of the pump beams. If the frequencies of the pump beams are equal, then the resulting nonlinear current generates a new radiation at frequency twice the frequencies of the pump beams— a phenomenon known as SHG. Starting from nonlinear Schrodinger wave equation a set of coupled differential equations governing the evolution of beam widths of the laser beams and power of generated second-harmonic radiation with longitudinal distance has been obtained with the help of variational theory. The equations so obtained have been solved numerically to envision the effect of laser as well as plasma parameters on the power of generated second-harmonic radiation.

Topics

Session B. Laser physics and modern optoelectronics

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