Seminar

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Institute for Plasma Research

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Title: Second Harmonic Generation and Optical Guiding of Laguerre-Gaussian Laser Beam in Plasma

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Date: 12th June 2025 (Thursday)

Time: 03:30 PM

Venue: Seminar Hall, IPR

Abstract

The second harmonic generation and optical guiding of the Laguerre-Gaussian laser beam in plasma have been investigated. Starting from the Maxwell's equations, we obtain a wave equation for an electromagnetic wave propagating in a nonlinear medium. The method of moments along with the Wentzel-Kramers-Brillouin (W.K.B.) approximation has been used to obtain the expression for spatial variation of the laser spot size in terms of beam width parameter along the direction of laser propagation.

An excited electron plasma wave coupled with the pump beam generate a second harmonic wave. The effect of the laser self-focusing on the second harmonic generation has been observed for different laser and plasma parameters. The intensity profile of the laser beam has been taken as the Laguerre-Gaussian. In particular, the effect of higher Laguerre-Gaussian modes on second harmonic generation has been observed for different nonlinearities.

To optically guide the pump laser beam, a preformed plasma channel has been introduced. Additionally, a ramp in plasma density caused by the plasma pressure in plasma generated by a laser beam has been used. Numerical results have been obtained by Runge-Kutta fourth order method.

The investigation led to the result that laser self-focusing as well as the second harmonic yield are more prominent for higher Laguerre-Gaussian mode as compared to the fundamental Gaussian mode. Preformed plasma channel and density ramp significantly enhance the laser self-focusing and its second harmonic yield.