9th Asia-Pacific Conference on Plasma Physics, 21-26 Sep, 2025 at Fukuoka

Second harmonic generation of high power Cosh-gaussian laser beam in Cold Quantum plasma

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The current study aims to examine the Second harmonic generation (SHG) of high power Cosh-gaussian (ChG) laser beam in Cold Quantum plasma (CQP). The self-focusing of the Cosh-gaussian (ChG) laser beam is due to relativistic nonlinearity which results in a modification in the dielectric function of the plasma. The density gradients are generated perpendicular to the direction of motion. Which generates excitation of electron plasma waves (EPW) at the pump wave frequency. Now the non-linear interaction between the pump wave and the stimulated EPW produces 2nd harmonics in plasma. The second order differential equation describing the propagation properties of a ChG beam with a normalized propagation distance is obtained using the Wentzel-Kramers-Brillouin and paraxial ray approximation. we have also used The Runge–Kutta 4 method to perform numerical simulations to investigate the effects of different laser and plasma parameters on the beam waist of a ChG beam and the conversion efficiency of the 2nd harmonics.

In addition, we have conducted a comparison between the Cold Quantum Plasma (CQP) and the Classical Relativistic Plasma (CRP) regime. These findings have significant importance in the field of laser-induced fusion

References

[1] Walia, K., Singh, T., & Singh, A. (2022). Effect of self-focused Cosh-Gaussian beam on second harmonic generation in collisional plasmas. Optik, 258, 168894.

[2] Walia, K., & Singh, T. (2023). The influence of a self-focused laser beam on the stimulated Raman scattering process in collisional plasma. Communications in Theoretical Physics, 75(12), 125503.

[3] Singh, T., & Walia, K. (2024). Impact of High-Power Cosh-Gaussian Beam on Second Harmonic Generation in Collisionless Magnetoplasma. Journal of Contemporary Physics (Armenian Academy of Sciences), 59(3), 254-264.

[4] Singh, T., Walia, K., & Tripathi, D. (2024). Propagation characteristics of q-Gaussian laser beam in collisionless magnetized plasma. Journal of Optics, 1-7.