Известия НАН Армении, Физика, т.60, №4, с.599–600 (2025)
DOI: 10.54503/0002-3035-2025-60.4-599

NONLINEAR INTERACTION OF HERMITE–COSH GAUSSIAN LASER BEAM IN COLD COLLISIONLESS PLASMA

K. WALIA*, K. SINGH, T. SINGH

Department of Physics, DAV University Jalandhar, India

*e-mail: keshavwalia86@gmail.com

(Поступила в редакцию 20 октября 2025 г.)

The present problem investigates nonlinear interaction of Hermite–Cosh Gaussian (HChG) beam in cold collisionless plasma. The ponderomotive force results in carriers redistribution away from beam's axis thereby leading to generation of gradients of intensity inside plasma. These gradients of intensity cause self-focusing of beam. The beam's field vector wave equation in cold collisionless plasma is solved with established paraxial theory to obtain 2nd order ODE for beam waist of beam. Since, analytical solution of this equation is not possible. So, this is numerically solved using Runge–Kutta 4th order method for examining response of beam waist against dimensionless distance. We have also examined effect of notable parameters of laser and plasma including plasma density, plasma temperature, beam intensity, decentered parameter and beam radius on response of beam waist of beam.

ЛИТЕРАТУРА

1. Wilks, S.C., Dawson, J.M., Mori, W.B., Katsouleas, T., and Jones, M.E., *Phys. Rev. Lett.,* 1989, vol. 62, p. 2600.
2. Corkum, P.B., Rolland, C., and Rao, T., *Phys. Rev. Lett.*, 1986, vol. 57, p. 2268.
3. Sprangle, P., Esarey, E., and Krall, J., *Phys. Plasmas,* 1996, vol. 3, p. 2183.
4. Faure, J., Glinec, Y., Pukhov, A., Kiselev, S., Gordienko, S., Lefebvre, E., Rousseau, J.P., Burgy, F., and Malka, V., *Nature,* 2004, vol. 431, p. 541.
5. Walia, K., *Optik*, 2021, vol. 225, p. 165592.
6. Walia, K., Sharma, P., and Singh, A., *Optik*, 2021, vol. 245, p. 167627.
7. Walia, K. and Singh, A., *Optik*, 2021, vol. 247, p. 167867.
8. Lemoff, B.E., Yin, G.Y., GordonIII, C.L., Barty, C.P.J., and Harris, S.E., *Phys. Rev. Lett.,* 1995, vol. 74, p. 1574.
9. Walia, K., *Commun. Theor. Phys.,* 2023, vol. 75, p. 095501.
10. Walia, K. and Tripathy, A., *J. Appl. Spectrosc.,* 2025, vol. 92, p. 335. `
11. Mahmoud, S.T. and Sharma, R.P., Phys. *Plasmas* 2001, vol. 8, p. 3419.
12. Yu, W., Yu, M.Y., Xu, H., Tian, Y.W., Chen, J., and Wong, A.Y., *Laser Part. Beams*, 2007, vol. 25, p. 631.
13. Milchberg, H.M., Durfee III, C.G., and Mcllrath, T.J., *Phys. Rev. Lett.*,1995, vol. 75, p. 2494.
14. Tobey, R.I., Siemens, M.E., Cohen, O., Murnane, M.M., Kapteyn, H.C., and Nelson, K.A., *Opt. Lett.,* 2007, vol. 87, p. 286.

15. Hora, H., *Laser Interaction and Related Plasma Phenomena, vol.4B*, Plenum: New York, 1977.
16. Kane, E.L. and Hora, H., *Laser Interaction and Related Plasma Phenomena*, Plenum, New York, 1977.
17. Sodha, M.S. and Tripathi, V.K., *J. Appl. Phys.,* 1977, vol. 48, p. 1078.
18. Sodha, M.S., Mittal, R.S., Kumar, S., and Tripathi, V.K., *Opto-electronics,* 1974, vol. 6, p. 167.
19. Akhmanov, S.A., Sukhorukov, A., and Khokhlov, R., *Sov. Phys. Uspekhi.,*1968, vol. 10, p. 609.
20. Sodha, M.S., Ghatak, A.K., and Tripathi, V.K., *Progress in Optics*, North Holland; Amsterdam, 1976.
21. Hora, H., *Zeitschrift fur Physik*, 1969, vol. 226, p. 159.
22. Hora; H., Badziak, J., Read, M.N., et al., *Phys. Plasmas*, 14, 072701 (2007).
23. Lalousis, P., Moustaizis, S., Hora, H., and Miley, G.H., *J. Fusion Energ.*, 2015, vol. 34, p. 62.
24. Hora, H., *J. Opt. Soc. Am.*, 1975, vol. 65, p. 882.
25. Wang, Y. and Zhou, Z., *Phys. Plasmas,* 2011, vol. 18, p. 043101.