Suppression of stimulated forward Raman scattering by static density fluctuations in the presence of magnetic field in ICF scheme

Oriza Kamboj[1]*, Ashish Yadav[2], Devki Nandan Gupta[3], John Pasley[4] and Niti Kant[1]

[1]Department of Physics, Lovely Professional University, Punjab, India, [2]Mindfire Solutions, Noida, India, [3]Department of Physics & Astrophysics University of Delhi, Delhi, India, [4]York Plasma Institute, Department of Physics, University of York, United Kingdom

*e-mail (speaker): kambojoriza1964@gmail.com

Abstract.

Stimulated Raman scattering (SRS) is one of the issues limiting the power scaling in inertial confinement fusion (ICF). In this work, we demonstrate effective suppression of SRS by the combined effects of static density fluctuations and azimuthal magnetic field. In the presence of an azimuthal magnetic field, a gaussian laser beam propagating through a density rippled plasma undergoes stimulated forward Raman scattering (SFRS), resulting in two radially localized electromagnetic sideband waves and a lower-hybrid wave. Absolute and growing modes saturate due to ion density fluctuations, which then suppress instability growth through mode coupling. The modes modified by the azimuthal magnetic field are effectively damped after saturation. As a result, the overall growth rate of the instability reduces. Based on nonlocal theory, we have analysed the growth of the SFRS and estimate it for ICF relevant parameters.

Figure.

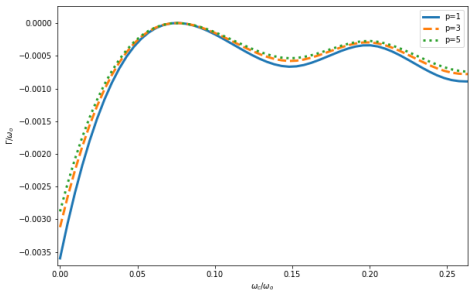

Figure 1: Variation of Normalized growth rate with normalized cyclotron frequency

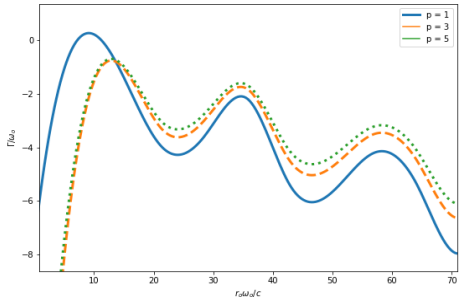

Figure 2: Variation of normalized growth rate with normalized spot size

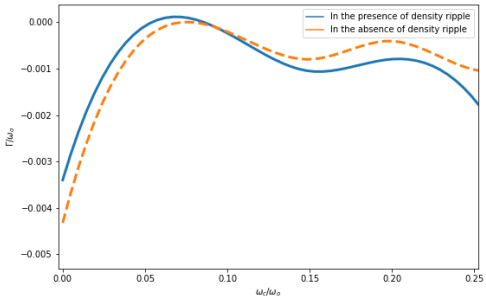

Figure 3:Variation of Normalized growth rate with normalized cyclotron frequency in the presence and absence of density ripple.

References

[1] J. Nuckolls and L.Wood, Nature (London) 239, 139 (1972). [2] J. Lindl, Phys. Plasmas 2, 3933 (1995). [3] T. Gong, J. Zheng, Z. Li, Y. Ding, D. Yang, G. Hu, and B. Zhao, Phys. Plasams 22, 092706 (2015). [4] H. C. Barr and F. F. Chen, The Physics of fluids 30, 1180-1188 (1987). [5] V. Sajal, D. Dahiya, and V. Tripathi, Physics of plasmas 14, 032109 (2007).