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P5.4003 Stimulated Raman scattering of the multi-Gaussian beam in a relativistic plasma

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In the present work, the non-linear propagation of multi-Gaussian beam, consisting of coherent Gaussian beams with similar distribution [1], has been studied in collision-less plasma in the relativistic regime. We investigated the stimulated Raman scattering (parametric instability) of electromagnetic wave pulse and the evolution of its spot size. A theory of stimulated Raman scattering is developed by the composition of the hydrodynamic model and Maxwell's equations. We drive mode structure equation governing the amplitude mode, from which the fundamental mode and the Eigenvalue are found. The equations are coupled with low-frequency electron and ion plasma oscillations. It is observed that in the transition from weak to strong relativistic plasma, the growth rate for stimulated Raman scattering (SRS) instability is reduced. However, the presence of strong axially external magnetic field can further supress the SRS instability [2]. Numerically, we obtained the frequency shift and the growth rate of scattered off EM wave. The effect of eccentric displacement on the evolution of spot size has been uncovered by using WKB approximation and non-paraxial theory. It has been observed that the relativistic non-linearity strongly depends on the eccentric displacement as the beam possesses different radial intensity distributions for its different value. Oscillating focusing as well as defocusing has been observed in different cases.

Reference
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[2] Pan, K. Q., Guo, L., Li, Z. C., Yang, D., Li, S. W., Jiang, S. E., ... & He, X. T. (2019). Stimulated Raman scattering instability of a left-handed circularly polarized laser in strongly axially magnetized plasmas. Physics of Plasmas, 26(1), 012108.

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