Saturation of stimulated Raman scattering due to the excitation of stimulated Brillouin scattering

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The nonlinear coupling between stimulated Raman scattering (SRS) and stimulated Brillouin scattering (SBS) of intense lasers in underdense plasma is studied theoretically and numerically. Based upon the fluid model, their coupling equations are derived and a threshold condition of plasma density perturbations due to SBS for the restricted saturation of SRS is given. Particle-in-cell simulations show that this condition can be achieved easily by SBS produced ion density perturbations in the so-called fluid regime with $k_L¥lambda_D <0.15$, where k_L is the Langmuir wave number and $¥lambda_D$ is the Debye length [1]. SBS can reduce the saturation level of SRS and the temperature of electrons in both homogeneous and inhomogeneous plasma. Numerical simulations also show that this reduced SRS saturation is retained even if the fluid regime condition mentioned above is violated at later time due to plasma heating.

References

[1] J. Kline , et al., Phys. Plasmas 13, 055906 (2006)