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Laser beam smoothing techniques including the use of broad bandwidth signals and their effect on high energy density plasmas

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Backward stimulated Raman scattering is a three-wave coupling instability requiring the matching of an incoming pump light wave to a scattered light wave and electron plasma wave. It can be harmful to laser-driven inertial confinement fusion because of the reflection of a part of incident laser flux and the generation of suprathermal electrons that preheat the fuel.

It is believed that by increasing the laser bandwidth one can suppress the excitation of Raman scattering and mitigate its detrimental effects. In this talk we discuss the previously published results [1] where in 1D broadband radiation is shown to have little effect due to trapping effectively broadening the frequency of excited plasma waves and so also matching conditions for SRS.

We then move on to 2D simulations, where trapping is not as pronounced, and find that broadband radiation alone appears to still be insufficient to prevent SRS in the kinetic regime. We also discuss some of the modelling of broadband radiation and the problems in properly predicting suppression of SBS.

Finally we discuss the results from diffraction calculations for a variety of optical setups as an introduction into the next stage of this work.

References:
[1] Phys. Rev. E 110, 065207 – (2024) DOI: https://doi.org/10.1103/PhysRevE.110.065207