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Backward Raman Amplification in the Wavebreaking Regime[1]
ZEEV TOROKER, Technion - Israel Institute of Technology, VLADIMIR MALKIN, NATHANIEL FISCH, Princeton University — Backward Raman amplification in plasma is based on a 3-wave resonant interaction, which includes two-counter propagating laser pulses (pump and seed pulses) and an electron plasma wave (Langmuir wave). In the regime of large laser to plasma frequency ratio, where the phase velocity of the Langmuir wave is small, the Raman amplification can be inefficient due to the trapping of electrons in the plasma wave, destroying the wave coherency. This process, known as wavebreaking, becomes dominant as the quiver velocity of the electrons approaches the phase velocity of the Langmuir wave. The quiver energy is proportional to the pump intensity, so the wavebreaking limits the pump intensity. However, we show that, for pump intensity up to about ten times the wavebreaking threshold and for cold enough plasma, it is still possible to have moderately efficient Raman amplification. For too large pump intensity or too hot plasma, the efficiency of the Raman amplification decreases significantly as predicted by [Malkin et al., Phys. Rev. Lett. 82, 4448 (1999)].

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