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Evidence of Strong Damping in Raman Amplification: Comparison between Simulations and Experiment

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Raman amplification in plasma is a possible source of ultra-short, ultra-intense laser pulses. The use of plasma as a gain medium offers the potential to avoid the damage threshold associated with solid-state amplification media. However, wavebreaking and damping may act to limit amplification, while amplification of spontaneous scatter can destroy the quality of the amplified pulse.

Despite these limitations, recently published experimental results[1] demonstrate gains higher than can be achieved using conventional amplifiers. Understanding the underlying processes is vital if these results are to be built upon, working towards an amplification method that can be applied to applications. By comparing simulations to experimental results, this work investigates the role of damping on amplification, which has a significant impact at the lower pump amplitudes typically suggested to avoid plasma wavebreaking.

References

[1] G. Vieux, S. Cipiccia, D. W. Grant, N. Lemos, P. Grant, C. Ciocarlan, B. Ersfeld, M. S. Hur, P. Lepipas, G. Manahan, G. Raj, D. Reboredo Gil, A. Subiel, G. H. Welsh, S. M. Wiggins, S. R. Yoffe, J. P. Farmer, C. Aniculaesei, E. Brunetti, X. Yang, R. Heathcote, G. Nersisyan, C. L. S. Lewis, A. Pukhov, J. M. Dias, D. A. Jaroszynski, "An ultra-high gain and efficient amplifier based on Raman amplification in plasma", Scientific Reports (in press).

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