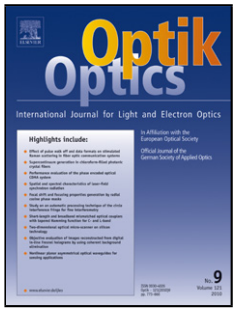

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PII: S0030-4026(17)31103-8
DOI: http://dx.doi.org/10.1016/j.ijleo.2017.09.043
Reference: IJLEO 59651

To appear in:

Received date: 27-5-2017
Accepted date: 11-9-2017

Please cite this article as: Zeinab Mahdian, Saeed Mirzanejhad, Taghi Mohsenpour, Meisam Taghipour, Polarization influence on the backward Raman amplification through chirped pump laser pulse, Optik - International Journal for Light and Electron Opticshttp://dx.doi.org/10.1016/j.ijleo.2017.09.043

Polarization influence on the backward Raman amplification through chirped pump laser pulse

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Abstract

Seed pulse amplification with a chirped pump laser pulse via Raman backward scattering is investigated through numerical simulations. The optimal dimensionless chirp value for selected parameters in this article is in the range $10^{-5} \leq \left|\propto/\omega_p^2\right| \leq 4 \times 10^{-5}$. Also, the effect of the polarization of the pump and seed pulses is investigated. Numerical results showed that circular polarization has comparative advantage. The enhancement factor for circular polarization in the optimum chirp has increased to 6% compared with linear polarization.

Keywords: Raman Amplification; Chirped pulse; Particle In-Cell Simulation

Introduction

Recently, noticeable improvements have been made in generation and amplification of very short (in order of femtosecond) and high intense laser pulses (in order of $10^{18}\frac{W}{cm^2}$) by using the Chirped Pulse Amplification technique that is based on stretch, amplification and then recompression of the seed pulse [1-5]. From both practical and theoretical points of view, high-intensity and ultra-short lasers have wide applications in compact X-ray lasers [6-8], particle acceleration [9-11], ultra-compact wakefield accelerators [12], fast ignition schemes for inertial confined fusion [13-14], and high harmonic generation [15] and nuclear physics [16].

This method has limitations in achieving high intensity and power since the breakdown threshold of optical components in these systems can destroy the quality of pulse profile. Furthermore, this scheme requires broad-bandwidth high-fluency amplifiers. Therefore, to avoid these limitations, a suitable alternative has been suggested for the CPA method, in which plasma is used as an amplification medium that is called stimulated Raman backscattering. The