Numerical modeling of stimulated Raman scattering with selective amplification

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Abstract

This work suggests a mathematical model to simulate Stimulated Raman Scattering (SRS) with selective amplification of specific Stokes lines. This phenomena was observed experimentally when the laser excitation energy (E-L) was above the dissociation energy of the Raman medium (D-R), while the Stokes line showing amplification was in close proximity of an atomic emission line. The proposed numerical model suggests an influence of a stimulated emission factor in addition to the normal SRS behavior. This model was applied to the Raman medium of H-2 gas, with the fourth harmonic of the Nd:YAG laser, 266 nm. At this wavelength, the energy of the laser excitation source is above the dissociation limit of H-2 gas. In addition, the Stokes 3 line is in close proximity of the Balmer H-epsilon line. A comparison between simulated and experimental results was undertaken which showed good agreement. This concluded that the proposed model, which took stimulated emission into consideration, was a good explanation for the high conversion efficiency of the third Stokes lines as compared to other observed Stokes lines. The model also aided in the understanding of the selective amplification process of specific Stokes lines and the factors that influenced it. (C) 2015 Elsevier Inc. All rights reserved.

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