MULTIFREQUENCY RAMAN GENERATION

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Non-parametric stimulated Raman scattering is well-established as a simple and efficient method of converting laser radiation to one or more lower (Stokes) frequencies. However, parametric Raman conversion to higher frequencies, or the simultaneous generation of multiple Raman lines, has generally been found to be much less efficient. The common assumption has been that, for optimal conversion of the input energy, the phase-matching conditions for the parametric processes dictate the geometry of the interacting waves. Radiation is therefore generated over a wide range of angles, resulting in low interaction lengths and a multifrequency "beam" that cannot be focused to a single spot.

We have shown that the collinear generation of higher orders, in the presence of finite dispersive phase mismatch and with fully symmetric pumping (input pulses of matching intensity and shape), has much greater potential. Results to date predict that the generation of a *single* multifrequency beam consisting of nearly 50 waves of comparable energy is possible [1]. Furthermore, we have shown the existence of two distinct regimes of ultra-broadband light generation - the coherent and incoherent regimes [2]. In the coherent regime we have discovered that a large number of long-lived soliton pulse trains are spontaneously generated at the distinct Raman frequencies [3].

The most immediate application of this work is in the field of inertial confinement fusion where the use of an ultra-broadband light source may overcome several problems related to the transmission and delivery of high optical energy [4]. However, the predicted magnitude of bandwidth generated is such that our results may also find application in other areas such as measurement techniques, spectroscopy and sensing. The current stage of this new work will be reported.

References

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