A Raman approach for ultrafast optical technology

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Abstract

Optical processes in a resonant three-level system, using quantum interference as a key, resulted in a wide variety of fascinating phenomena, ranging from electromagnetically induced transparency (EIT), through ultrafast light, to manipulation of quantum coherence at the single-photon level. On the other hand, the extension of an equivalent three-level system to far-off resonance is opening various applications to use it as light sources including collinear generation of broad stimulated Raman scattering (SRS), ultrashort pulse generation, and the like. The key point in the far-off resonance three-level system is to drive the maximal Raman-coherence adiabatically by controlling a small two-photon detuning from the Raman resonance [1]. Figure 1 shows an example of collinearly generated octave-spanning high-order SRS series based on near-maximal coherence produced at a rotational Raman transition of J = 0 to 2 in para-hydrogen [2]. In our talk, we will review the studies on the far-off resonant three level system [1 - 14], including recent progress such as an arbitrary optical waveform generation and so on.