

Phase Control in Population Inversion Using Chirped Laser

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Abstract : We have presented a phase control scheme in population transfer using chirped laser fields. A chirped pulse can do population transfer from one level to another level via adiabatic rapid passage accessible by one photon dipole transition. We propose to use a pair of phase-locked chirped pulses of the same frequency $w(t)$ instead of a singly chirped-pulse frequency $w(t)$. Simultaneous action of phase controlled interference in addition to rapid adiabatic passages due to chirped pulses lead to phase control over this population transfer dynamics. We have demonstrated the proposed phase control scheme over the population distribution from the initial level $X(v=0,j=0)$ to $C(v=2,j=1)$ level of hydrogen molecule using a pair of phase-locked and similarly chirped laser pulses. We have extended this two-level system to three-level 1+1 ladder system of hydrogen molecule from X level to final $J(v=2,j=2)$ level via C intermediate level using two pairs of laser pulses having frequencies $w(t)$ and $w'(t)$ respectively and obtained laudable control over the population distribution among three levels. We also have presented some results of interference effects of $w_1(t)$ and its third harmonics $w_3(t)$.

Keywords : phase control, population transfer, chirped laser pulses, rapid adiabatic passage, laser-molecule interaction

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