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Adaptive quantum control of two photon fluorescence on Coumarin 30 by using evolutionary algorithm MILAN POUDEL, ALEXENDER KOLOMENSKI, HANS SCHUESSLER, Texas A&M University — Two-photon excitation fluorescence of complex molecules (Coumarin-30) is successfully optimized by using feedback control pulse shaping technique. For such an optimization we have implemented an evolutionary algorithm [1], [2] in a Lab-view programming environment with a liquid crystal pulse shaper in a folded 4f set up. In the algorithm, one generation uses 48 individuals (vectors of voltage on the LC matrix).For each generation the fitness value is measured for every setting of the mask. A new generation is built from the previous by combining parents (the fittest individuals) and producing the desired degree of mutations (changes of the vector elements by some random value) to provide reasonable convergence. By successive repetition of this scheme, individuals corresponding to the highest fitness values will survive and produce offspring's for subsequent generations. Typically, convergence to the optimum value was achieved after 30 generations. Without any prior knowledge of the molecular system, the optimization goal was automatically achieved by changing the spectral phases [3]. The pulses before and after optimization were measured with GRENOUILLE, a type of second harmonic frequency resolved optical gating (SH FROG). To find the efficient pulse with lower intensity, three types of optimization were performed, the two photon fluorescence signal, the second harmonic signal and the ratio between them. The Intensity of two photon fluorescence of coumarin-30 could be increased noticeably compared to the transform limited pulse optimizing the second harmonic generation. The experimental results appear to be the potential applications of coherent control to the complicated molecular system as well as in bio medical imaging.

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Milan Poudel
mpoudel@physics.tamu.edu
APS

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