

Sub-cycle ultrafast modulation of the optical properties of the dielectrics by an intense laser field

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Abstracts: *We found the subcycle change of the optical properties of the diamond under an intense laser field employing the first-principle calculation. The ultrafast modulation is caused by the interference between the dressed states.*

Intense ultrashort pulse laser has been widely used for the ultrafast phenomena in solid states and/or the non-thermal laser processing. In such highly nonlinear and fast processes, new theoretical approach, real-time description including nonlinear and/or non-perturbative, is indispensable.

We developed the first-principle real-time approach by solving the time-dependent Kohn-Sham equation [1]. Recently, we predict the unknown laser induced sub-cycle change of the optical properties, time-resolved dynamical Franz-Keldysh effect (Tr-DFKE)[2], by employing the first-principle calculation and analytical formulation. We found that the Tr-DFKE shows the interesting phase shift with respect to the pump light electric field. This phase shift is owing to the interference between many different paths in dressed states induced by the pump light. Since the phase of the wavefunctions of the dressed states is locked, the phase difference between them causes the time-evolution of the optical responses.

[1]T. Otobe, M. Yamagiwa, J. -I. Iwata, K. Yabana, and G. F. Bertsch, Phys. Rev. B 77, 165104 (2008)

[2]T. Otobe, Y. Shinohara, S. A. Sato, and K. Yabana, Phys. Rev. B 93, 045124 (2016)