

Joint CQSE and CASTS Seminar

Weekly Seminar
Apr. 8, 2016 (Friday)

TIME Apr. 8, 2016, 14:30 ~ 15:30
TITLE Multiphoton Processes of Atomic and Molecular Systems in Intense Ultrashort Laser Fields
SPEAKER Dr. John Heslar
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PLACE Rm716, CCMS & New Physics Building, NTU

Abstract

In this talk, we discuss some recent highlight regarding the nonperturbative study of novel highly nonlinear optical phenomena in intense ultrashort laser fields. Multiple high-order harmonic generation (HHG) is the most important metrology for the generation of ultrashort attosecond (10-18 sec) laser pulses. Much has been studied in the HHG well above the ionization threshold, while less attention has been paid to the study of the near- and below (ionization) threshold harmonics where the electron structure plays a major role and many delicate highly nonlinear optical phenomena remain to be explored.

Below- and near-threshold harmonic generation also provides a potential approach to achieve a high conversion efficiency of vacuum-ultraviolet (VUV) and extreme-ultraviolet (EUV) sources for the advancement of spectroscopy. We have recently performed an all-electron time-dependent density functional theory (TDDFT) study for the nonperturbative treatment of below- and near-threshold harmonic generation of CO and N₂ diatomic molecules subject to short near-infrared (NIR) laser pulses and aligned parallel to the laser field polarization. We find that with the use of different driving laser pulse shapes, we can control and enhance harmonic generation through the excited state resonance structures. Our analysis reveals several novel features where the HHG signal is enhanced, boosting the conversion efficiency on the microscopic level. Depending on the pulse shape, the enhancement can reach 5 to 7 orders of magnitude as compared to the reference sine-squared laser pulse of the same duration.

