CFEL SCIENCE

SEMINAR

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CFEL-bldg. 99, seminar room IV

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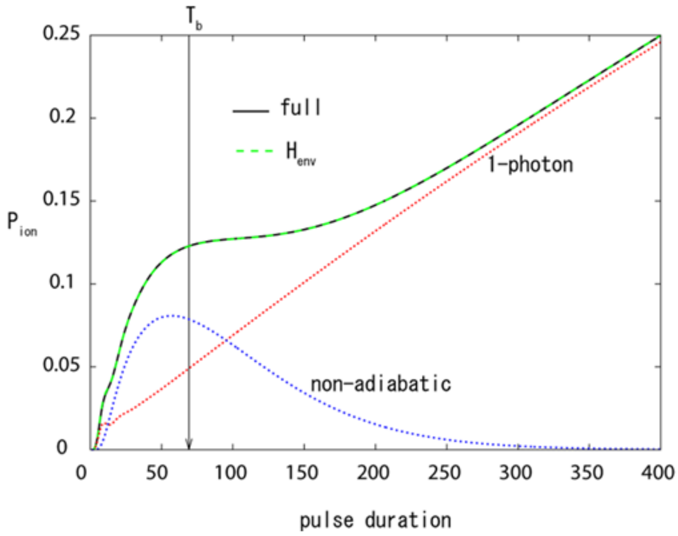
The envelope Hamiltonian in high-frequency regime

Recent experimental developments have motivated us to study light-matter interactions in high-frequency regime. Here, the terminology of 'high-frequency' means that photon energy of a pulse is high enough to ionize a target with single photon. For instance, the high order harmonic generation techniques can create coherent light sources in soft x-ray regime with pulse duration of atto second time scale. Such a noble light source enables us to study ionization dynamics in ultrashort time scale, where the pulse duration is comparable with electron's orbiting period.

In this talk, we introduce the effective Hamiltonian to study light-matter interactions in high-frequency regime, which is surprisingly simple but accurate enough to extract physics from results of the full time-dependent Schroedinger equation. The derivation of the effective Hamiltonian is implemented by the Floquet expansion method in the Kramers-Henneberger frame with an envelope function being regarded as an adiabatic variable. The time-dependency of the envelope is thus explicitly remained in the effective Hamiltonian, so we call it the envelope Hamiltonian.This is natural ansatz for long pulse limit, however we show that a certain devise make the envelope Hamiltonian also exact in short pulse limit where it is expected that the Floquet expansion no longer exists. The adiabatic approximations based on the envelope Hamiltonian show us that all the essential physics can be captured, namely, not only photon absorption, but also light induced shifts, non-adiabatic transitions. These are demonstrated utilizing a simple model in the talk.



Host: Robin Santra – CFEL-DESY Theory Division