# Analysis of Electromagnetic Fields
# Radiated from an Electron in Laser Fields by Hybrid Simulation

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Hybrid simulation of the Maxwell's and Schrödinger's equations has attracted attention as a tool to analyze electronic devices based on quantum effects. One of representative examples is a carbon nanotube transistor which operates under the quantum mechanical current and electric voltage. Our proposed hybrid simulation can evaluate both quantum and classical nature: the quantum mechanical current density generated from the motion of wave functions of electrons is subjected to the Schrödinger's equation and the total field including the electromagnetic wave radiated from the quantum current is evaluated by the Maxwell's equations. The interaction between electrons and electromagnetic fields are precisely simulated in time domain by using the above hybrid process.

In this talk, we will investigate electromagnetic fields radiated from an electron by using our hybrid simulation based on the Finite Difference Time Domain (FDTD) method for the Maxwell's and Schrödinger's equations. An electron is constrained by a harmonic oscillator and incident laser fields are narrow pulses which can excite an electron to a certain higher energy level. Furthermore, we have applied the length gauge to expedite the computational process. In the quantum mechanics, the current density is changed by the distribution of the wave function. We will discuss the electromagnetic fields radiated from an electron due to the distribution of the wave function and change of the electron states when an electron discharges the energy.