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## Atomic and Molecular Physics, attosecond physics, computational physics

Progress of science and technology bring new topics to atomic molecular and optical physics. Nowadays, the laser pulse duration can be squeezed to attosecond scale, and beam focused to a small area such that intensity is quite high. The laser duration is in the same scale of atomic electron orbiting period, such that the real-time electronic dynamics has been realized. In 1973, Kroll and Watson developed the laser assisted electron scattering theory. But the theory is not enough for current situations. Our research intends to develop new computational methods and perform research for some emerging problems.

1. The non-dipole effects for intense long wavelength laser pulse on atom, molecule.
2. In recent experiments, the ordinary dipole approximation theory is not enough to describe new results. We will build the non-dipole method for current interested problems.
3. The light interaction with graphene. The realization of graphene layer inspires many new research activities. We will keep working in the light-graphene problems.
4. The non-Hermitian quantum mechanics (NHQM) will be useful to the problem of time-dependent interacted quantum system. The time-dependent NHQM calculation is not straightforward. We will develop theoretical method and apply to intense field problems, and to SQUID related problems.
5. The quantum dynamics of anti-hadronic helium (XHe) atom under laser pulse. After decades efforts, CERN reaches the optical experiments with the XHe system. In the system, X is a negative charge hadron such as anti-proton, anti-kaon etc. X replaces one electron of the helium atom and forms a metable system with life time in microsecond. The time scale is enough for ultrafast experiment as showed. The X has several hundred times mass of electron. XHe is two-centered system but one center is negative charged while another one is positive. It is a new system in between atom and diatomic molecule (two positive charged centers). Our preliminary study showed the distinguished behaviors of photoelectron spectrum and high-order harmonic generations.

For our research results, please visit the website : http://web.it.nctu.edu.tw/~tfjiang/