Announcing the Final Examination of Yan Cheng for the Degree of Doctor of Philosophy in Physics

Date: Thursday, 10/15/2015
Time: 1:00 p.m.
Room: Physical Science 160
Dissertation title:
ATTOSECOND TRANSIENT ABSORPTION SPECTROSCOPY OF ATOMS AND MOLECULES

Abstract:
One of the most fundamental goals of attosecond science is to observe and to control the dynamic evolutions of electrons in matter. The attosecond transient absorption spectroscopy is a powerful tool to utilize attosecond pulse to measure electron dynamics in quantum systems directly. In this work, isolated single attosecond pulses are used to probe electron dynamics in atoms and to study dynamics in hydrogen molecules using the attosecond transient absorption spectroscopy technique. The target atom/molecule is first pumped to excited states and then probed by a subsequent attosecond extreme ultraviolet (XUV) pulse or by a near infrared (NIR) laser pulse. By measuring the absorbed attosecond XUV pulse spectrum, the ultrafast electron correlation dynamics can be studied in real time. The quantum processes that can be studied using the attosecond transient absorption spectroscopy include the AC stark shift, multi-photon absorption, intermediate states of atoms, autoionizing states, and transitions of vibrational states in molecules. In all experiments, the absorption changes as a function of the time delay between the attosecond XUV probe pulse and the dressing NIR laser pulse, on a time scale of sub-cycle laser period, which reveals attosecond electron dynamics. These experiments demonstrate that the attosecond transient absorption spectroscopy can be performed to study and control electronic and nuclear dynamics in quantum systems with high temporal and spectral resolution, and it opens door for the study of electron dynamics in large molecules and other more complex systems.

Outline of Studies:
Major: Physics

Educational Career:
MS in Physics, Kansas State University, 2011
BS in Physics, University of Science and Technology of China, 2009

Committee in Charge:
Dr. Zenghu Chang (Chair)
Dr. Lee Chow
Dr. Hari Saha
Dr. Eric W. Van Stryland (External Committee Member)

Approved for distribution by Dr. Zenghu Chang, Committee Chair, on October 8, 2015.

The public is welcome to attend.