The Scaling of Strong Field Atomic Physics

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Over the last twenty years, the tailoring of a light field for manipulating the dynamics of a system at the quantum level has taken a prevalent role in modern atomic, molecular and optical physics. As first described by Keldysh [1], the ionization of an atom by an intense laser field will evolve depending upon the light characteristics and atomic binding energy. Numerous experiments have thoroughly investigated the dependence of the intensity and pulse duration on the ionization dynamics of atoms. However, exploration of the wavelength dependence has been mainly limited to wavelengths less than 1 mm, or in the language of Keldysh to the multiphoton or mixed ionization regime. It is now technically possible to perform more thorough test, and perhaps exploit, the scaling laws at wavelengths greater than 1 mm. In addition, excitation with mid-infrared light augments a variety of atomic and molecular systems that will tunnel ionize, as well as posing different model atomic structure, e.g. one- and two-electron like systems.

The lectures will describe basic strong field phenomena, develop the basic scaling metrics, introduce the semi-classical description and examine the consequences of wavelength on the production of higher energy particles, attosecond light pulses and molecular imaging.

1. L.V. Keldysh, Sov. Phys. JETP **20**, 1945 (1964).