

Ionization in Atomic and Solid State Physics

Paul Corkum
University of Ottawa, Canada

Ionization is an atomic molecular and optical physics process that has important implications for plasma physics. What one field learns has significance for the other. Atomic ionization (and inter band transitions in solids) by infrared light is well approximated by tunnelling. After ionization, the electron and ion motion is equally well approximated by semi-classical physics – bringing the electron back to its origin (recollision) and creating coherent XUV (or soft X-ray light) whose duration is controllable and can be as short as a few 10's of attoseconds.

In plasmas, oscillating electrons can also lead to XUV radiation, but incoherent radiation, called bremsstrahlung. This same process in plasmas contribute to "air lasing" in N_2 molecular ions and it can help pump an inversion in highly charged ions. In molecules ionization, followed by recollision image a molecules structure and that of its valence electrons and to follow chemical dynamics. In solids, we can determine the band structure of semiconductors all optically.

In my talk, I will discuss some of these implications.