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Combined Ion and Laser Field Effects in Intense Laser Ionization of Atoms and Molecules¹ ROBERT JONES, University of Virginia

The simpleman's approximation and it's extension to the 3-step model have been extremely successful in guiding our understanding of strong field processes in atoms and molecules and the development of applications from molecular imaging through electron rescattering and HHG, to the attosecond streak camera. Even so, the principal approximations, adiabatic tunneling ionization followed by laser driven electron dynamics in a flat ionization continuum are not always applicable. We have been investigating two such problems. The first is near threshold ionization in the presence of a low frequency field. In this case, the field of the parent ion can dramatically influence the momentum and energy transfer to the continuum electron. The second is multi-electron dissociative ionization (MEDI) of small molecules (e.g. N₂, O₂, CO, NO) in asymmetric fields. It has long been recognized that non-adiabatic electron localization during the dissociation of a molecule in the presence of an intense laser can lead to the production of higher charge states. The use of asymmetric laser fields allows us to test the directionality of the dissociation predicted by the enhanced ionization model and the time-scales over which electron localization may occur.

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