Modeling Double Hole Dynamics in Intense Laser Produced Xenon Cluster Plasmas

TZVETELINA PETROVA, Naval Research Laboratory, KENNETH WHITNEY, Berkeley Research Associates, JACK DAVIS, GEORGE PETROV, Naval Research Laboratory — When femtosecond laser pulses with intensities greater than $\sim 10^{19}$ W/cm$^2$ interact with a cluster of xenon atoms, the atoms are stripped of their N-shell electrons in less than a femtosecond and a Coulomb explosion ensues with ions initially in the ground state of Ni-like xenon. X-ray lasing at $\sim 2.86$ Å has been observed in such cluster explosions [1] and gain coefficients were measured. Gains comparable to those measured have been obtained in the single hole states of Co-like xenon in an initial non-equilibrium theoretical analysis of these experiments [2]. Alternatively, x-ray amplification has also been attributed to the generation of population inversions between double and single hole states in the M-shell ions of xenon [3]. In order to investigate the viability of this possibility, we have added double hole states to the Fe-like ionization stage of our detailed ionization dynamic model of Ni-, Co-, and Fe-like xenon [2]. Results from our model calculations will be presented in this talk.


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