Abstract Submitted
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Mechanism of Resonance-enhanced X-ray Multiple Ionization of Argon Atom in an XFEL Pulse[1] LINDA YOUNG, PHAY HO, Argonne National Laboratory — We present a new Monte Carlo rate equation (MCRE) approach to examine the inner-shell ionization dynamics of atoms in an intense x-ray free-electron laser (XFEL) pulse. In addition to photoionization, Auger decay and fluorescence processes, we include bound-to-bound transitions in the rate equation calculations. This computational tool allows us to account for "hidden resonances" [1] unveiled in high charge states of atom in XFEL pulse. Using our MCRE approach, we investigated the ionization dynamics of Argon atom exposed to an 480-eV XFEL pulse. At this photon energy, it is not energetically allowed to produce Ar ions with charge 10+ and higher via direct one-photon L-shell ionization. Rather, we found that the resonance-enhanced x-ray multiple ionization (REXMI) pathways [2] play a dominant role in producing these highly charged ions. Our calculated results agree with the measured Ar ion yield data [3]. More importantly, we account for the pulse-duration dependence of experimental ion yield data and identify the responsible REXMI pathways where excitation of multiple electrons into outer valence and Rydberg orbitals are followed by autoionization. [1] E. Kanter *et al.* Phys. Rev. Lett **107**, 233001 (2012). [2] B. Rudek *et al.* Nat. Photonics **6**, 858 (2012). [3] S. Schorb *et al.* Phys. Rev. Lett **108**, 233401 (2012).

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