

New opportunities in x-ray spectroscopy at high intensity

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Understanding the interaction of intense x-ray pulses with atoms is crucial for many experiments with x-ray free-electron lasers (XFELs). When atoms are exposed to XFEL pulses, they undergo complex ionization dynamics, producing transient exotic states and highly charged ions after absorbing many x-ray photons sequentially. This x-ray multiphoton ionization mechanism has been the key concept to understand the XFEL-atom interaction, since the first XFEL experiment of Ne gas was conducted. I will briefly review the x-ray multiphoton ionization model and introduce a dedicated theoretical toolkit, XATOM. Can we visualize the complex charge-up pathways? Will it be possible to map out all the transient resonances that are formed during the ionization dynamics? With a combination of latest development of XATOM and free tunability of the photon energy at European XFEL, I will present how to answer those questions and discuss new opportunities of x-ray ion spectroscopy and x-ray emission spectroscopy with intense XFEL pulses.

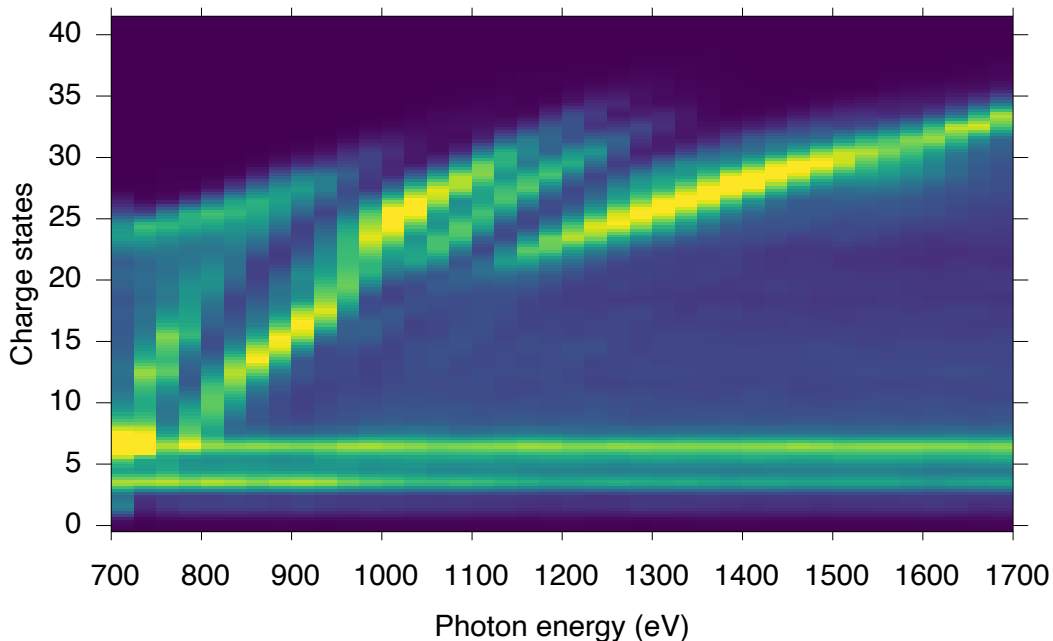


Figure: Xe charge-state distribution as a function of photon energy.