CFEL SCIENCE

SEMINAR

20th September 2023 - 2:00 p.m.

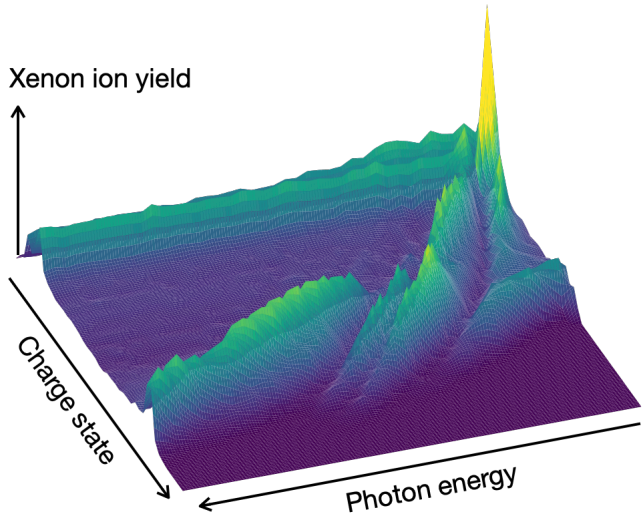
CFEL-bldg. 99, seminar room IV

Sang-Kil Son

Center for Free-Electron Laser Science, DESY, Germany

Multiple-core-hole resonance spectroscopy with ultraintense X-ray pulses

Understanding the interaction of ultraintense and ultrafast X-ray pulses with heavy atoms is crucial for gaining insights into the structure and dynamics of matter. One key aspect of nonlinear light-matter interaction is its dependence on the photon energy, but there has been no systematic study of X-ray free-electron lasers (XFELs) so far. I will present a joint theoretical and experimental study of highly charged xenon ions after interaction with XFEL pulses scanning the photon energy over a wide range of 1 keV. The measured and calculated ion spectra in a photon-energy and charge-state landscape contain a plethora of information about the electronic structure and transient resonances. In particular, the theoretical analysis reveals that massively hollow atoms featuring up to six simultaneous core holes are formed during the complex charge-up pathways. I will explain how to predict and interpret the resonance ion spectra in connection with formation of multiple-core-hole states. Also I will illustrate how the extraction of resonance spectra benefits from saturation effects at very high fluences.



Quantum landscape of xenon charge states

Host: Robin Santra – CFEL-DESY Theory Division