James P. Cryan (SLAC)

Title - Studying Attosecond Electron Dynamics with X-ray Free Electron Lasers

Abstract - Electron motion is a key ingredient of all chemical reactions. It is also the means by which light energy is harnessed in photochemistry. The natural timescale for such electronic motion is set by the electron's binding energy to be in the range of tens to hundreds of attoseconds. Consequently, the study of ultrafast electronic phenomena requires the generation of laser pulses shorter than 1 fs, and of sufficient intensity to interact with their target with high probability. Free Electron Lasers (FELs), such as the Linac Coherent Light Source (LCLS), offer interesting opportunities to achieve these conditions, allowing for the probing of electrons on this natural time scale, elucidating the earliest processes involved in chemical change.

In this talk, I will present our first results showing isolated attosecond soft X-ray pulses from the FEL, with peak power approaching the terawatt scale. Such high power pulses open the door for nonlinear spectroscopies such as pump/probe spectroscopy, and X-ray wave mixing, where we demonstrated the preparation of a coherent electronic wavepacket by driving stimulated X-ray Raman scattering. Combing attosecond X-ray pulses with an external laser field we are able to time-resolve the photoemission dynamics of core-level electrons in molecules.

Bio - James Cryan is a Staff Scientist at SLAC National Accelerator Laboratory. He is a member of the Stanford PULSE Institute, where leads the attosecond science group. James' research focuses on studying electron dynamics on the attosecond time scale and developing tools to better probe these phenomena.

James completed his undergraduate education at The Ohio State University. He received his PhD in physics from Stanford University in 2012. From 2012 to 2014, James was a Postdoctoral scholar in the Chemical Sciences Division at Lawrence Berkeley National Laboratory. In 2015 he joined SLAC as a Staff Scientist in the Stanford PULSE Institute. In 2012, James won the Spicer Young Investigator award for his thesis work at the LCLS.