

UCLA Department of Physics & Astronomy

# COLLOQUIUM

Thursday, November 4, 2021 at 4 p.m.

## Attosecond X-ray movies: the frontier of ultrafast science

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Electron motion initiates most chemical reactions, and it is an essential component of fundamental light-matter interactions. The dynamics of bound electrons in atoms, molecules and solids happen on very fast time scales, from few femtoseconds down to the sub-femtosecond regime. Therefore, the study of electronic processes on their natural timescales requires pulses of light faster than one femtosecond, and of sufficient intensity to interact with their sample with high probability.

The recent generation of attosecond pulses from an X-ray free-electron laser (at the Linac Coherent Light Source at SLAC) marks the beginning of a new era of attosecond science. XFELs can generate pulses that are more than a million times brighter than conventional attosecond light sources and pave the way to molecular pump/probe movies with sub-fs resolution.

In my talk I will briefly describe the physics of X-ray free-electron lasers and report our recent advances in attosecond X-ray pulse generation. I will then show our recent experimental results in measuring attosecond coherent electron motion in molecules. Finally, I will discuss possible avenues towards brighter and shorter X-ray pulses using the next generation of particle accelerators.

Undergraduates Welcome!