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## Attosecond-Resolved Soft X-Ray Excitonics (I)

*Monday, 11 June 2018 11:45 (30 minutes)*

Attosecond Physics explores ways to follow and control matter with unprecedented temporal resolution (1 attosecond =  $10^{-18}$  s.). Strong laser fields used to apply forces on the sub-cycle timescale, together with the availability of tabletop attosecond soft x-ray pulses, now open avenues for time-resolving ultrafast dynamics on the unexplored attosecond timescale [1, 2]. In this first attosecond pump - attosecond probe experiment, an isolated 100 eV attosecond pulse initiates an Auger decay followed by an attosecond broadband (250-1100nm) optical pulse. The observable is the soft x-ray absorption spectrum as a function of pump-probe delay. A first experiment in krypton atoms allows us to model the effect of the optical probe as a gate of the Auger electronic dipole, a universal analog to the *frequency-resolved optical gating* technique [3]. Applying our attosecond x-ray absorption near-edge spectroscopy (AXANES) to the L-edge of fused silica enables us to directly observe and control sub-femtosecond core-excited states in solids, laying the foundation of soft x-ray excitonics.

[1] J. B. Bertrand et al., *Nature Physics* **9**, 174 (2013).

[2] S. R. Leone et al., *Nature Photonics* **8**, 162 (2014).

[3] R. Trebino, *FROG*, Kluwer Academic Publishers, Boston (2002).

[4] A. Moulet, J. B. Bertrand, T. Klostermann, A. Guggenmos, N. Karpowicz, E. Goulielmakis, *Science* **357**, 1134-1138 (2017).

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