



Contribution ID: 2

Type: **Contributed Talk**

## Radiation damage in serial femtosecond crystallography

*Tuesday, 16 September 2014 09:35 (25 minutes)*

Serial femtosecond crystallography (SFX) is an emerging technique for protein structure determination. SFX has been proposed as the method of choice for data collection of highly radiation sensitive systems such as nanocrystals in general and e.g. metalloproteins. Previous high resolution SFX measurements performed at the LCLS do not show any signs of radiation damage at a dose of <100 MGy. However, analyzing smaller and smaller samples will require higher flux densities resulting in GGy doses. Our recent damage experiments at LCLS explored this high dose regime using X-ray emission spectroscopy (XES) showing pulse length and pulse fluence dependent ionization of iron. High dose SFX experiments on a small protein containing two iron-sulfur clusters show distinct damage of the two clusters both below and above the iron K absorption edge (7.1 keV). These experimental results give insights into radiation induced damage processes in biological macromolecules that contain high Z centers at high intensity X-ray sources.

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