Contribution ID: **35** Type: **Contributed Talk**

Macromolecular Crystallography at XFELs and LCLS: Current Status, Limitations and Future Plans

Tuesday, 16 September 2014 10:25 (25 minutes)

One of the early success stories of XFELs is the technique of Serial Femtosecond Crystallography (SFX), where crystals are illuminated by the x-ray pulses one at a time and the biomolecular structure is deduced from integrating all these measurements. After a few years of development, the technique has reached some level of maturity. In this talk I will quickly review the state of macromolecular crystallography at XFELs and at LCLS in particular, both for 3D and 2D crystals.
With a few years of operation of LCLS behind us, some issues and limitations with the SFX technique have been identified. These include technical issues such as sample delivery and sample quantities, software limitations and fundamental issues with the beam parameters such as the spectrum of the SASE beam. I will discuss limitations and present results from experiments that have attempted to address these issues. For example, the use of the seeded FEL beam for crystallography will be discussed.
Finally, future plans for LCLS in the area of macromolecular crystallography will be presented, including a plan for a new LCLS endstation as well as the use of multiplexing and serial operation of multiple stations at LCLS. Also, as LCLS moves towards as high repetition rate machine, along with the European XFEL, recent results using high speed imaging of exploding liquid jets will be presented. These results have direct implication on the ultimate usable repetition rates for XFELs with liquid jets.

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Session Classification: Biology

Track Classification: Biology