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”Molecular movies of Biomolecules in action with X-Ray Free Electron Lasers and status on building the world’s first compact XFEL”

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“ Molecular movies of Biomolecules in action with X-Ray Free Electron Lasers and status on building the world’s first compact XFEL”

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Biological processes are highly dynamic, while most of the structures of biomolecules determined by X-ray crystallography and cryo-EM represent a static picture of the molecule frozen in time and space. Serial Femtosecond crystallography (SFX) provides a novel concept for structure determination, where X-ray diffraction “snapshots” are collected from a fully hydrated stream of nanocrystals, using femtosecond pulses at high energy X-ray free-electron lasers [1,2]. The femtosecond pulses from XFELs are so strong that they destroy any sold material but they are shorter than the time-scale of most damage processes, thereby femtosecond crystallography overcomes the problem of X-ray damage in crystallography [3]. Fs crystallography extends to atomic resolution [4,5] and has been applied to important membrane protein drug targets crystallized in lipidic environments [6-10]. Experiments on the proof of principle for time resolved serial femtosecond crystallography [11-16] pave the way for the determination of molecular movies of the dynamics of proteins “at work”. In my talk I show highlights of recent structural discoveries with X-ray Free Electron lasers [17-21] and report on the new development of compact X-ray Free Electron Lasers at Arizona State University.

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