Prospects for X-ray Diffraction Imaging of single Biological Molecules

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Short x-ray pulses from x-ray free electron lasers (XFELs) may enable diffraction imaging of single biological molecules. This would allow the determination of the structure of many molecules that have, to date, resisted crystallization. Since the appropriate sources will not be available for a few years, experimental design currently has to be done through simulations and modeling. Various aspects of the models are tested through experiments on currently available light sources.

In this presentation we will discuss numerous issues of the injection, irradiation, and imaging process. We will present our plans to model all aspects of the diffraction imaging endeavor, and the progress that we have made to date. Specifically, we will present an analysis of the pulse length and photon energy requirements by combining results from a continuum damage model [1] with a fluence requirement model [2]. We will further discuss several means to alleviate the pulse requirements, and compare the requirements with parameters of two planned x-ray lasers. Finally, we will present results from recent 3D imaging experiments at a resolution down to 10nm.

[1] Hau-Riege S.P., London R.A., Szoke A., *Phys. Rev. E,* 2004, **69**, 051906.
[2] Huldt G., Szoke A., Hajdu J., *J. Struct. Biol.,* 2003, **144**, 219.

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