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Solution measurements yield atomic scale resolution DEREK MENDEZ, JONGMIN SUNG, Stanford Applied Physics, DANIEL RATNER[1], Stanford Linear Accelerator Center, CLEMENT LEVARD, MARC MICHEL, GORDON BROWN, Stanford Geology, SEBASTIAN DONIACH[2], Stanford Applied Physics — A conventional measure on a solution of identical non-interacting particles (e.g. a dilute solution of proteins) is the scattering averaged over all particle orientations. Such scattering results in a 1-D profile, e.g. the standard powder diffraction rings. Here, we aim to recover information that is averaged out in such a measurement. By recording many short, bright X-ray pulses one can obtain the scattering fluctuation, i.e. the 2-photon correlation function. Intensity correlations arise from double scattering events in which two photons from an incoming beam scatter off the same particle, belonging to an ensemble of randomly oriented particles. The double scattering must occur during a single exposure, and before the scatterer has undergone significant diffusion. At wide angles, such correlations have the potential to yield Å-scale single-particle structural information. The problem is to extract correlated events from a background of uncorrelated single-photon scattering events. This is done by forming statistics over an ensemble of correlation measurements and comparing to correlations between uncorrelated pairs of exposures. Samples range from naturally occurring nano-minerals measured using focused synchrotron X-rays, to biomolecules measured using a free electron laser.

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