Intensity fluctuation spectroscopy using coherent x-rays

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X-ray intensity fluctuation spectroscopy (IFS) promises to provide unique direct measurements of the dynamics of atomic-scale disorder. In recent years several significant steps have been made in the development of x-ray IFS. In an experiment at NSLS, we demonstrated that it is possible to use a pinhole to extract an intense coherent hard x-ray beam from a high-brilliance synchrotron source. Such coherent x-ray beams have since been used to produce static x-ray speckle patterns from a variety of disordered systems. Exploratory x-ray IFS measurements have now been performed using high-brilliance sources at NSLS, CHESS, and ESRF, providing a better understanding of the technique. Examples from these studies will be presented. For practical application of x-ray IFS in the future, it will be necessary to develop brilliance-preserving x-ray optics to allow the coherence length of the beam to be matched to the correlation length in the sample, with minimal loss of coherent flux. We plan to continue the development of x-ray IFS using coherent x-ray beams from the new Advanced Photon Source.