5.5. Opportunities for high-pressure research at beamline 8-ID with X-ray Photon Correlation Spectroscopy

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Beamline 8-ID at the Advanced Photon Source has been developed to optimize coherence and beamline optical components stability in order to perform X-ray Photon Correlation Spectroscopy (XPCS) experiments. XPCS is a technique suited for the study of diffusive dynamics on time scale from microseconds to thousands of seconds. Two beamlines are available for XPCS experiments at beamline 8-ID, a Wide-Angle and a Small-Angle X-ray Scattering (SAXS) beamline. The 8-ID-I beamline focuses on SAXS experiments and operates primarily at 11 keV, which is well suited for transmission through diamond anvil cells. Pixel-array detectors such as the Medipix 3R Lambda detector enable studies down to 2 kHz. Area detectors are under developments with few microsecond frame rate enabling studies with unprecedented time resolution for XPCS [1]. Current areas of research will be discussed.

The 8-ID-E beamline is equipped with a 4-circle diffractometer for diffraction on single crystals, thin films and amorphous materials. Due to its fixed energy of 7.35 keV, it would require a special environmental chamber for high-pressure research. Recent work at ESRF on glassy dynamics of metallic glasses has generated a lot of interest in XPCS on the slow atomic dynamics near the glass transition. An example of recent work [2] and possible experiments will be discussed.

The MBA upgrade of the APS will produce few micron coherent beams with two orders of magnitude improvement in coherent flux over today's flux at 8-ID at much higher x-ray energies, and thus should broaden the scientific applications of XPCS.

References:

[1] Qingteng Zhang et al. Dynamic Scaling of Colloidal Gel Formation at Intermediate Concentrations, to appear in *Phys. Rev. Lett.* (2017)

[2] Qingteng Zhang et al., Thermal Fluctuations of Ferroelectric Nanodomains in a Ferroelectric-Dielectric $PbTiO_3/SrTiO_3$ Superlattice, *Phys. Rev. Lett*. **118**, 097601 (2017).