# X-Ray Intensity Fluctuation Spectroscopy of the Ordering in $Cu_3Au$

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$Cu_3Au$ has a first-order order-disorder phase transition at $T_c$=383 C which has been well studied. Recent work[1] using x-ray intensity fluctuation spectroscopy (XIFS) measured the two-time correlation functions during ordering in this system after quenching from above $T_c$ to below. The dynamics of the fluctuations are well characterized by the extension of dynamical scaling arguments for calculating these two-time correlations[2]. One puzzle in these measurements was the presence of an *incubation time* before the onset of this scaling behaviour. This incubation time, which can be as long as 40 minutes, occurs well after the time at which the system has reached the scaling region as determined by measurements of the average domain size (inverse of peak widths).

With upgrades to the IMMY/XOR side station at the Advanced Photon Source, both the intensity and the coherence factor required to perform XIFS measurements has been improved. This has allowed us to obtain better data in the early time region (many seconds and up). During this incubation the time, the central position of the (100) Bragg peak changes a small amount, the asymmetry in the ratio of in-plane and out of plane peak widths decreases slightly and the speckles shift in wavevector. The shift in speckle positions is more than the shift in the Bragg peak position and these shifts become less pronounced the further the sample is quenched below $T_c$. Using the intensity-intensity correlation function $\langle I(q_1,t_1)I(q_2,t_2)\rangle$ instead of $\langle I(q,t_1)I(q,t_2)\rangle$ allows us to compensate for the speckle shifts and obtain measureable correlation times. The implications on ordering kinetics in $Cu_3Au$ will be discussed.

**References**

[1] - A. Fluerasu, M. Sutton, and E.M. Dufresne, Phys. Rev. Lett., **94**, 055501 (2005)
[2] - G. Brown, P.A. Rikvold, M. Sutton and M. Grant, Phys. Rev. E, **65,** 6601-6612 (1997).