

ESRF2016 Report Tozer  
Proposal HC-817

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During our second high pressure study of alpha-uranium at ESRF (ID27 27-31July2016) we were able to clearly observe modulation structures and low angle scattering indicative of long range structure (unpublished results) which define the phase transition from the normal to the CDW states below 43 K. We now want to more closely study the region around the quantum critical point (QCP). These recent results and the additional ones we will obtain at ESRF will be coupled with our high pressure Fermiology studies carried out at NHMFL to understand the QCP and the superconducting state that masks it.

We stepped from 0.3 GPa up to approximately 1.5 GPa in roughly 0.3 to 0.5 GPa increments with one higher pressure at 3 GPa, taking structural data as the sample was cooled from 60 K to 3 K in roughly 5 K increments. Clear Bragg spots were seen above the CDW with no additional structure (Fig.1) and, upon cooling through the CDWs, lock-in was established. Beautiful satellite peaks were observed as the sample was cooled and dropped through these CDWs (Fig. 2). Observed low angle scattering also begs for inelastic studies on ID28. The very high quality U-238 single crystals (approx.. 80  $\mu\text{m}$  in diameter and 5-10  $\mu\text{m}$  thick) used in these ambient and high pressure studies were grown at our home institute using a modified electrochemical growth. In addition to the studies at ID27 and ID28, future high pressure studies of the magnetic field dependence would be intriguing as would full structural 4-axis diffractometer studies at as low a temperature as possible. The latter is made possible by our plastic diamond anvil cells which are transparent to x-rays. Safety note: the experiment has been determined to be “Green” by ESRF’s safety officers.

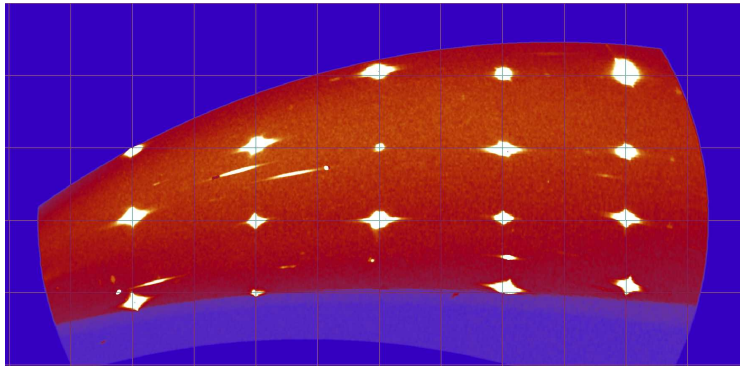


Figure 1 : T=40K, 3kbar, m2kl, high flux, Bragg peaks

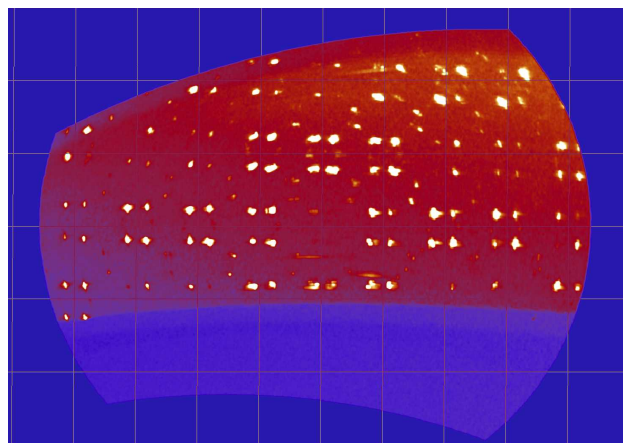


Figure 2 : T=3K, P=3kbar, m2.5kl, high flux with satellites, Bragg peaks removed