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Neutron Scattering Study of $URu_{1.9}Re_{0.1}Si_2$: Driving Hidden Order Towards Quantum Criticality TRAVIS WILLIAMS, McMaster University, N.P. BUTCH, University of Maryland, G.M. LUKE, McMaster University, M.B. MAPLE, University of California San Diego, Z. YAMANI, W.J.L. BUYERS, Chalk River Laboratories — We report inelastic neutron scattering measurements in the hidden order state of $URu_{1.9}Re_{0.1}Si_2$. We have fit the data to a resolution convolved simple harmonic oscillator model, plus a continuum extending to 10meV. We observe that towards the Quantum Critical Point (QCP) induced by Re-doping, the gapped incommensurate fluctuations are fairly robust, being nearly identical to the parent material. The gap at the commensurate point (1 0 0) is driven down as the doped system approaches the QCP. The response of this commensurate spin fluctuation associated with the hidden order acquires substantial damping. The particle-hole spectrum of nested fermions [1] can be fitted to the energy and damping of the excitations, but there is no evidence for the static charge density wave that the model implies [2], in agreement with STM [3]. We conclude that Re-doping weakens, but does not destroy, the hidden order on approaching the QCP transition to ferromagnetism.
[1] Balatsky et al. Phys. Rev. B 79 (2009) 214413
[2] Su et al. arXiv/cond-mat:1010.0767 (2010)
[3] Schmidt et al. Nature 465 (2010) 570
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