Vortex Induced Spin-Density Wave and Core Charge in $Bi_2Sr_2CaCu_2O_{8+y}$

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Competition with magnetism is at the heart of high temperature superconductivity, intensely felt near a vortex core. To investigate vortex magnetism we use a spatially resolved probe based upon NMR spin-lattice-relaxation spectroscopy in $Bi_2Sr_2CaCu_2O_{8+y}$. These experiments indicate a spin-density wave associated with a vortex,[1] consistent with results from elastic neutron scattering in other cuprates. In magnetic fields up to $H = 30$ T, we have determined the spin-modulation amplitude, found the decay length from the vortex core to be twice the coherence length, and that the period is $\sim 8a_0$.

At low fields $H < 10$ T, but still at magnetic fields much greater than that of the decoupling transition, we have observed a narrowing in the distribution of local fields with increasing applied field,[2] and interpret this observation as a vortex lattice structural instability associated with charge trapped on the core. Our calculation of the latter, to be consistent with the experiment, requires a charge of magnitude $\sim 2\text{x}10^{-3}e$ per vortex pancake, decreasing with increased doping.

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[1] A.M. Mounce, *et al.* Phys. Rev. Lett. **106**, 057003 (2011).

[2] A.M. Mounce,*et al.* Nature Physics **7**, 125 (2011)