Let’s go Zebra!

Stripy things: the questions.

The electronic things seen in underdoped cuprates suggesting strong electronic organization associated with spatial translations and rotations will be abbreviated with their nick name ‘stripy things’.

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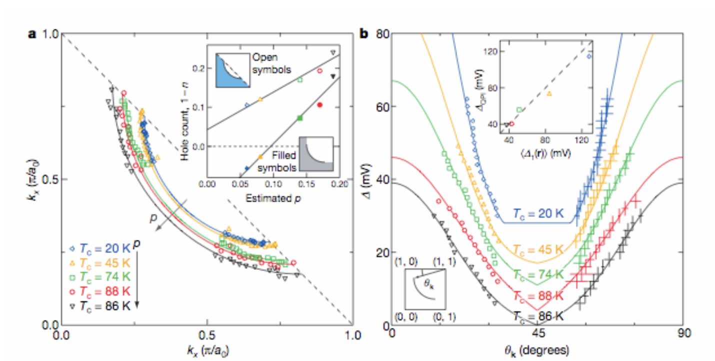
Question 1: Is there a direct relation between the ‘momentum space dichotomy’ and stripy things?

Are we convinced that the highly incoherent pseudogap states in the antinodal regime in momentum space reflect an unknown, non-mean field physics of stripy order? Has anybody seen a credible explanation of how to reconcile this with the apparently quite (‘small gap’) BCS like ‘nodal protectorate’? Where are the equations explaining that both momentum space regimes have a sharp existence, being separated by a more or less sharp boundary? Should we conclude that the fundamental equations of many-fermion quantum physics need to be rewritten?



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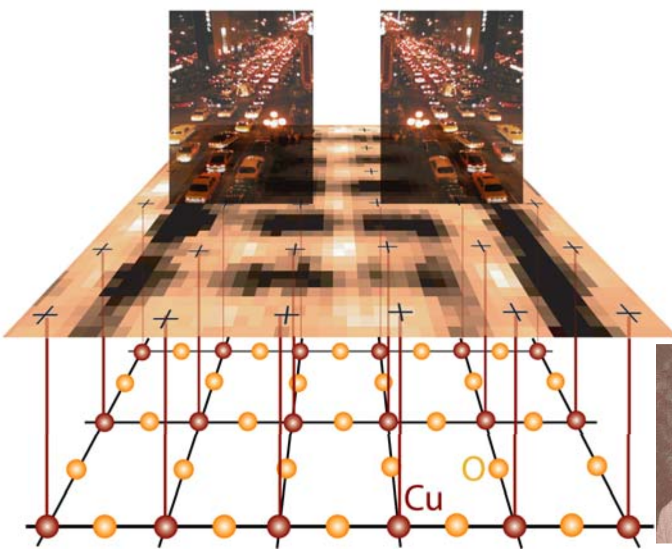
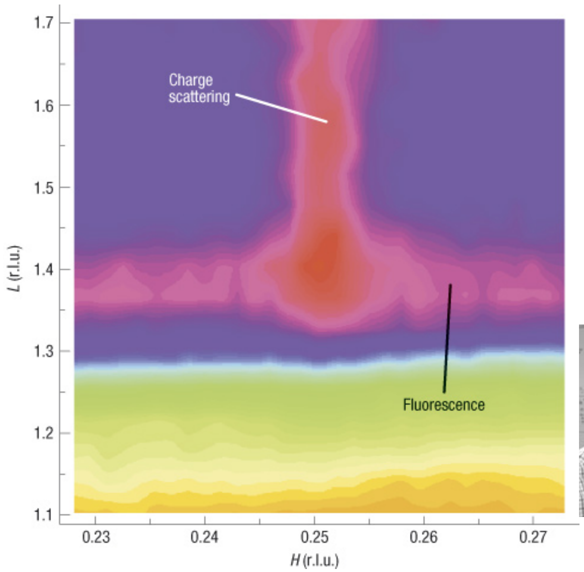
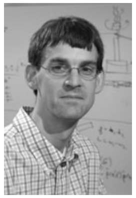
Question 2: are the STS stripy things a surface artefact?

The STS measurements (perhaps also ARPES, ZX Shen's latest) suggest that stripy things occur in static form over a wide doping range while bulk measurements (neutrons, resonant X-ray scattering) seem to insist that static order only occurs in LTT cuprates at x=1/8. Are static stripy things a surface artefact? If so, could it be that we are mislead by ARPES and STS? For instance, could it be that Varma's fluxes are much more important in the bulk but we do not quite get to see their electronic structure?



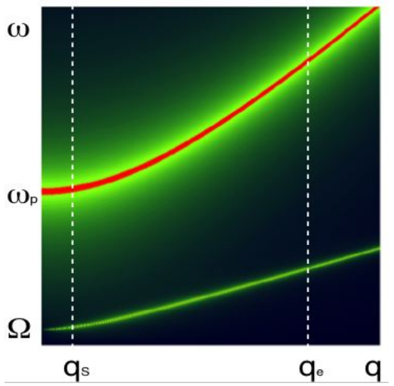




Question 3: is there an experimental observable that in an sharp and quantitative manner distinguishes strongly organized 'fluctuating stripes' from more 'gaseous' interpretations?

The hardship for the experimentalists is in the short time scales. The debate revolving around the 'hourglass' spin-fluctuation spectrum might go on forever -- neutrons cannot decide the issue. We have to think out of the box!

Some self-promotion: Cvetkovic et al. show that in a superconducting quantum-nematic a propagating collective 'shear photon' mode has to exist when the stripe correlation length is large compared to the lattice constant. This mode is visible in the electron loss spectrum, albeit in a difficult kinematical regime.



EPL 81, 27001 (2008)

Question 4: Anderson’s ‘stripes are a red herring’.

When Tc is maximal at optimal doping there is no persuasive evidence for the presence of substantial stripy things of any kind. How can they then do the hard pairing work? The only loop hole seems that the quantum nematic might come to an end at a Pomeranchuk type quantum phase transition at optimal doping, being responsible for a fermionic quantum critical state that in turn is extremely good for superconductivity. But should we believe that this stuff is muscular enough to explain linear resistivity at 2000K??