

# Effects of e-ph coupling on stripes in 2D Hubbard model

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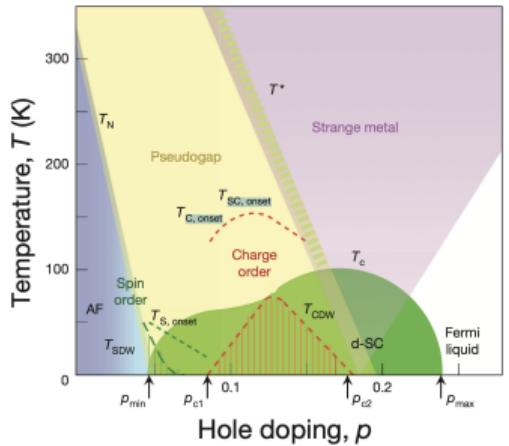
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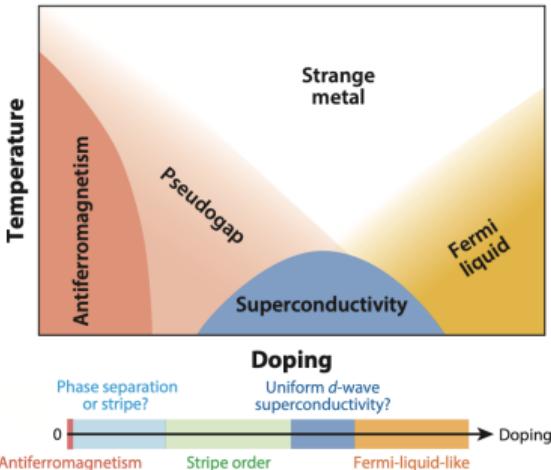
06 March, 2024



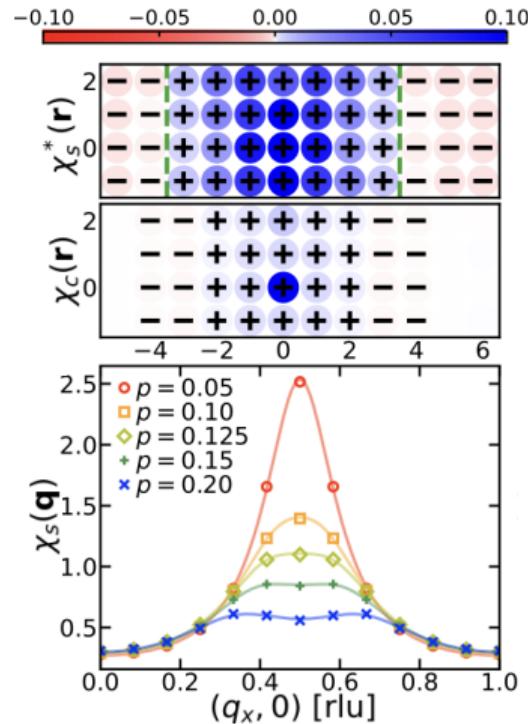
# What am I doing



Cuprate phase diagram  
Keimer. et al, 2015  
<https://doi.org/10.1038/nature14165>

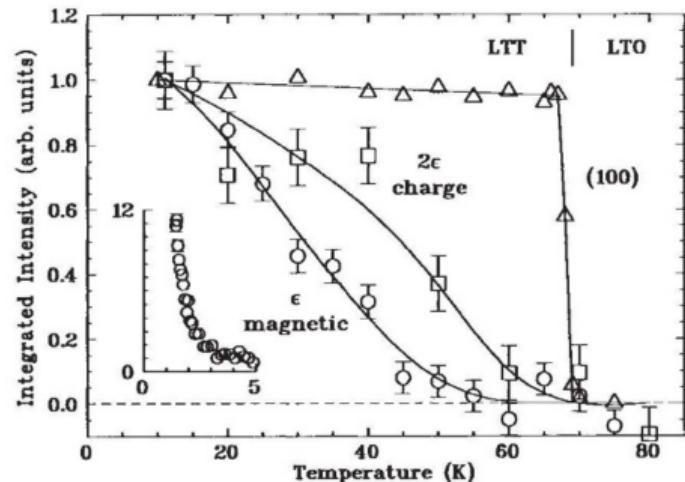


Hubbard Model Phase Diagram  
Qin. et al, 2022  
<https://doi.org/10.1146/annurev-conmatphys-090921-033948>



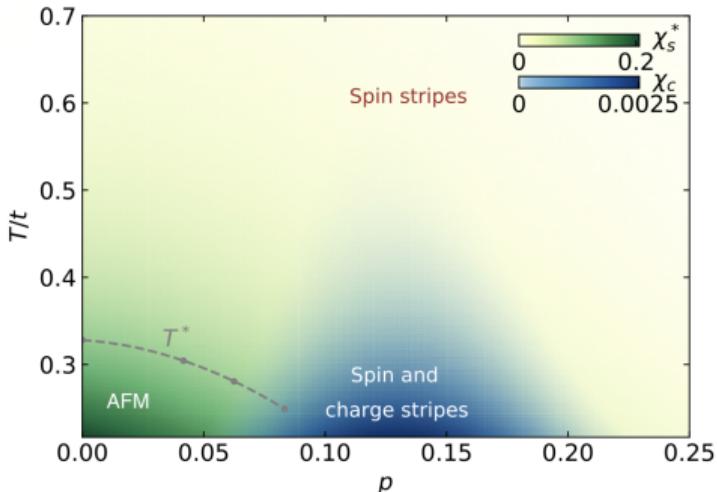
Stripes of CDW and SDW in position and  $k$ -space  
Edwin W. Hang et al, PRB107, 085126

# Motivation



Exp. peaks for SDW and CDW vs T

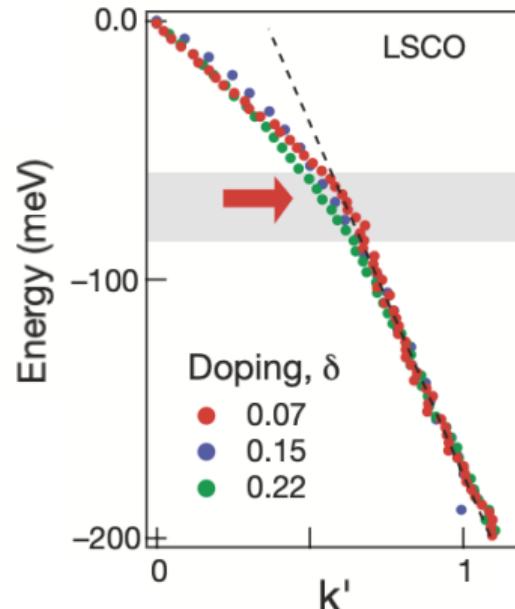
Tranquada, J. et al, Nature 375, 561–563 (1995)  
<https://doi.org/10.1038/375561a0>



Spin & Charge stripp intensities: Hubbard Model

Edwin W. Hang et al, PRB107, 085126  
<https://doi.org/10.1103/PhysRevB.107.085126>

## Our proposal



Kink due to e-ph coupling  
A. Lanzara, Nature volume 412, pages 510–514 (2001)  
<https://doi.org/10.1038/35087518>

b-SSH model demonstration/animation

In cuprates,  
 $t \sim 0.3 \text{ eV} = 300\text{meV}$   
 $\Omega \sim 70 - 100 \text{ meV}$   
 $\therefore \Omega(\max) \approx t/3 = 0.3t$   
 $\Omega = t/2 = 200\text{meV}$ : still very high, lower  $\Omega$  unexplored.



## Preliminary result

(plots of chi\_c:enhancement and shift of maxima and chi\_S:suppression)  
(del\_C and del\_S graph)  
(? : refer to charge overdoped paper for shift of maxima found there as well)  
Est: 1.5 min

## ...more on results

(pseudo gap result - for bond)

(Time to mention the caveat for modelling using b-SSH - Sohan's paper)

Est: 1 min

## Caveat

(Increase in bandwidth - contraction of band in b-SSH.)

conclusion - long story short..(no need of another slide, just say it),

work on  $T=0$  needed, encouraged,

suppersion(enhancement) of SDW(CDW) is clearly there.

Est: 2 min

## Acknowledgements

photos of Steve, Ben, funding(DOE)

Thank you!

Questions??

## Back-up slides / potential content; formatting

<sign> vs Beta

caveat of sign switching wth optical model

Why SSH not Holstein -(high Tc mech - ref)

Why  $p=1/8$

decrease of Mott gap

del\_C and del\_S analysis

maybe work on correlation length analysis on my data, see what is happening

correlation length plot for SDW and CDW

(e-ph results motivating more study) - wrong frequencies; so far papers on these  
keep focused on bond

What can be “intuitively” wrong when looking for very high  $\Omega$

Funding acknowledgement statement?

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