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What Stripes Tell Us about Superconductivity in Cuprates[1]

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Doping holes into the correlated-insulator state of CuO_2 planes frustrates the antiferromagnetic order and leads to an inhomogeneous state that can take the form of charge and spin stripes. The reduced dimensions of the spin stripes lead to the development of a singlet-triplet gap, while the interaction of the charge carriers with this environment can yield electron pairing. Rather than acting as a competing order, this intertwining of spin and charge correlations can result in superconductivity [1]. In particular, two-dimensional superconductivity has been observed to coexist with stripe order [2], and features of the resulting state have been explained by invoking the concept of a pair-density-wave superconductor [3]. The presence of real-space modulations presents a challenge for the conventional foundation of superconductivity theory, which is a gas of quasiparticles described only in terms of their momenta. Moreover, various spectroscopic measurements of striped and uniform cuprate superconductors look quite similar; hence, it seems likely that the pairing mechanism is common to cuprates spanning the range of hole doping. I will discuss the experimental picture, including recent evidence for the coexistence of truly static charge order [4] and gapless spin fluctuations [5,6] with superconductivity, and the implications for our understanding of these materials. [1] E. Fradkin, S. A. Kivelson, and J. M. Tranquada, Rev. Mod. Phys. **87**, 457 (2015). [2] Q. Li *et al.*, Phys. Rev. Lett. **99**, 067001 (2007). [3] E. Berg, E. Fradkin, S. A. Kivelson, and J. M. Tranquada, New J. Phys. **11**, 115004 (2009). [4] X. M. Chen *et al.*, Phys. Rev. Lett. **117**, 167001 (2016). [5] Z. J. Xu *et al.*, Phys. Rev. Lett. **113**, 177002 (2014). [6] H. Jacobsen *et al.*, Phys. Rev. B **92**, 174525 (2015).

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