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Insights from scanning tunneling microscopy experiments into correlated electron systems

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Citation

Benschop, T. (2023, September 26). *Insights from scanning tunneling microscopy experiments into correlated electron systems*. *Casimir PhD Series*. Retrieved from <https://hdl.handle.net/1887/3642190>

Version: Publisher's Version

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Propositions

Accompanying the thesis

“Insights from Scanning Tunneling Microscopy Experiments into Correlated Electron Systems”

1. The breakdown of the superconducting state in overdoped cuprates is not a result of a diminishing pairing interaction. [chapter 2]
2. In terms of twist angle homogeneity, open twisted bilayer graphene devices can rival the quality of fully encapsulated devices. [chapter 3]
3. The lack of evidence for superconductivity in open twisted bilayer graphene devices suggests a critical role for the encapsulating hBN layers in establishing superconductivity. [chapter 3]
4. The noise enhancements measured on the surface of Sr_2IrO_4 can be explained if substantial random telegraph noise is present in addition to the shot noise of tunneling electrons. [chapter 5]
5. The work by Kopp *et al.* claims that “ferromagnetic fluctuations in the superconducting state will act as pair breakers and [thereby] explain the demise of superconductivity in overdoped cuprates”, however, this is in contradiction with our observations. [Kopp *et al.*, PNAS **104**, 6123 (2007)]
6. The point contact spectroscopy measurements in the work by Oh *et al.* are no longer local, and therefore are not definitive proof that the spectroscopic gap measured with conventional STS is a result of superconductivity. [Oh *et al.*, Nature **600**, 240 (2021)]
7. The electronic effects attributed to tip-induced strain in the work of Mesple *et al.* can also (partially) be explained by tip-induced band bending effects. [Mesple *et al.*, PRL **127**, 126405 (2021)]
8. Regarding the work by Yan *et al.*, because the lack of intermittent atomic resolution images between deposition cycles, it is hard to attribute the observed V-shaped spectra to intrinsic physics of Sr_2IrO_4 . [Yan *et al.*, PRX **5**, 041018 (2015)]
9. The scientific community should be an example for the global society, where everybody, regardless of age, gender, ethnicity or political background, can participate.

Tjerk Benschop
Leiden, 26 September 2023