Theory of heat transport in dirty Superconductors -Joule Spectroscopy of InAs-Al devices-

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InAs nanowires with epitaxial grown Al facets constitute a workhorse geometry for many current quantum platforms; topologically trivial as well as non-trivial. Nonetheless, effects of heating and heat dissipation are not well understood in these systems, and can be potentially detrimental, as superconductors are notorious poor thermal conductors at low temperature. In this poster I present a theoretical study of heat dissipation of Joule heating via quasiparticles in dilute superconductors, and establish how emerging excess current dips [1] can be utilised to probe superconducting properties of either leads in etched Josephson Junctions [2].

References

[1] Tomi, M., Samatov, M. R., Vasenko, A. S., Laitinen, A., Hakonen, P., & Golubev, D. S. (2021). Phys. Rev. B, 104(13), 134513. doi: 10.1103/PhysRevB.104.134513

[2] Ibabe, A., Gomez, M., Steffensen, G. O., Kanne, T., Nygard, J., Yeyati, A. L., & Lee, E. J. H. (2022). arXiv, 2210.00569.

Figures

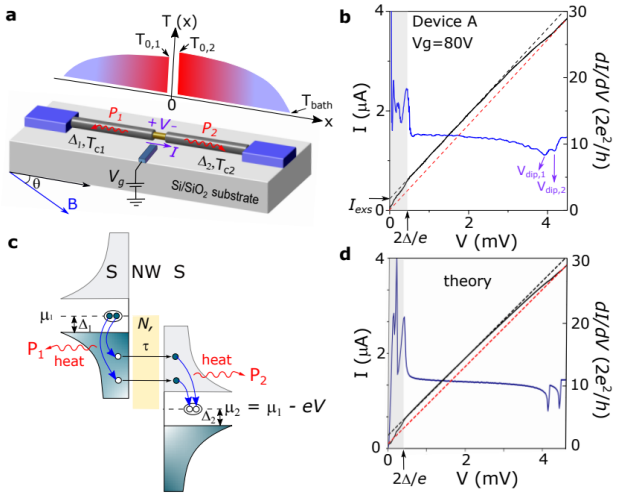

Figure 1: a Typical device geometry and illustration of temperature profiles. **b** V-I measurements showing high bias excess current dips. **c** Illustration of Joule heating in devices. **d** Theoretical calculated V-I curves showing dips.

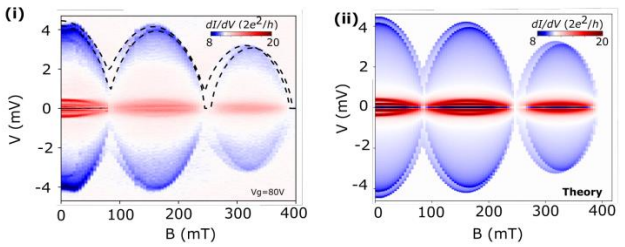

Figure 2: (i) High bias conductance measurements as a function of magnetic field. Little-Park oscillations of excess current dips are clearly visible. Dashed lines indicate fits to a simple theoretical estimate. **(ii)** Full self-consistent in temperature Keldysh-Floquet calculations of conductance.