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Talk Title: Tunnelling transport in strongly interacting atomic Fermi gases

Abstract: Tunneling transport measurements provide a powerful tool to unveil the coherence properties of a many-body system. Here, I present our results on the dynamics of fermionic superfluids weakly-coupled through a tunable tunneling barrier. In the absence of any applied chemical potential difference, we measure the Josephson critical current and we extract the condensed fraction of fermionic superfluids [1]. We then characterise the operation of our atomic junction across the superfluid transition. We find that Josephson supercurrents vanish when approaching the critical temperature due to condensate depletion. Remarkably, we observe the condensate to contribute also to resistive currents through the coupling with Bogoliubov-Anderson phonons [2]. Our work highlights the key role of transport measurements to disclose the nature of quantum materials.

[1] W. J. Kwon et al., *Science* 369, 84 (2020)

[2] G. Del Pace et al., *Phys. Rev. Lett.* 126, 055301 (2021)