Dissipation in a Josephson junction between fermionic superfluids

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We study the emergence of dissipation in an atomic Josephson junction [1] between weakly-coupled superfluid Fermi gases. We find that vortex-induced phase slippage is the dominant microscopic source of dissipation [2]. We link the junction transport properties to the phase-slippage mechanism, finding that vortex nucleation is primarily responsible for the observed trends of conductance and critical current. For large excitations, we observe the irreversible loss of coherence between the two superfluids, and transport cannot be described only within an uncorrelated phase-slip picture [2]. Our results open new directions for investigating the interplay between dissipation and superfluidity in strongly-correlated fermionic systems and for exploring concepts peculiar of quantum many-body systems out of equilibrium.

[1] G. Valtolina et al., Science 350**,** 1505 (2015)
[2] A. Burchianti et al. arXiv:1707.02784v1 (2017)