Josephson effect in strongly-correlated atomic superfluids

<u>G. Roati</u>

CNR, Istituto Nazionale di Ottica (INO), LENS and University of Florence, Italy

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 superfluids¹. 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 depletion². Our work highlights the key role of transport measurements to disclose the nature of quantum materials.

Submitting/Contact Author:Giacomo RoatiE-mail:giacomo.roati@ino.cnr.it

References

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²G. Del Pace, et al. Phys. Rev. Lett. 126 (2021)