Contribution ID: **53** Type: **Poster**

Nonequilibrium Transport in a Superfluid Josephson Junction Chain: Is There Negative Differential Conductivity?

Wednesday 4 September 2024 17:00 (2 hours)

We consider the far-from-equilibrium quantum transport dynamics in a 1D Josephson junction chain of multi-mode Bose-Einstein condensates. We develop a theoretical model to examine the experiment of R. Labouvie et al. [Phys. Rev. Lett. 115, 050601 (2015)], wherein the phenomenon of negative differential conductivity (NDC) was reported in the refilling dynamics of an initially depleted site within the chain. We demonstrate that a unitary c-field description can quantitatively reproduce the experimental results over the full range of tunnel couplings, and requires no fitted parameters. With a view towards atomtronic implementations, we further demonstrate that the filling is strongly dependent on spatial phase variations stemming from quantum fluctuations. Our findings suggest that the interpretation of the device in terms of NDC is invalid outside of the weak coupling regime. Within this restricted regime, the device exhibits a hybrid behaviour of NDC and the AC Josephson effect. I will also discuss open questions and future directions.

References

Begg, S. E., Davis, M. J., Reeves, M. T., Phys. Rev. Lett. 132, 103402 (2024)

Short bio (50 words) or link to website

Undergraduate at University of Western Australia, before a PhD at King's College London with Joe Bhaseen. Then a post-doc at the Asia Pacific Center for Theoretical Physics in South Korea with Ryo Hanai and a post-doc at Oklahoma State University with Thomas Bilitewski.

Relevant publications (optional)

PRL 132, 103402 (2024) https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.132.103402

Other works on non-equilibrium systems (not superfluids):
PRL 132, 120401 (2024) https://journals.aps.org/prl/abstract/10.1103/PhysRevLett.132.120401

PRR 5, 043288
https://journals.aps.org/prresearch/abstract/10.1103/PhysRevResearch.5.043288

Career stage

Postdoc

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Presenter: BEGG, Samuel (Oklahoma State University)

Session Classification: Posters II

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