Contribution ID: **13** Type: **Contributed talk**

Bose polarons in a box: universal features and the effects of finite temperature

Wednesday 4 September 2024 10:20 (20 minutes)

An impurity immersed in a quantum bath is a fundamental setting in many-body physics that, in spite of its apparent simplicity, features complex emergent behaviour. I will present our recent experiments in which we measure the spectral properties and real-time dynamics of mobile impurities injected into a homogeneous Bose–Einstein condensate (BEC), using two Feshbach resonances to tune both the impurity-bath and intra-bath interactions. We map out the attractive and repulsive branches of polaron quasiparticles and explore the breakdown of the quasiparticle picture for near-resonant interactions. On the repulsive side of the resonance, we resolve both the repulsive polaron and the molecular state associated with the Feshbach resonance in the strongly interacting regime and show that the latter also has a many-body character. Our measurements reveal remarkably universal behavior, controlled by the bath density and a single dimensionless interaction parameter, with no significant dependence on the intrabath interactions. Finally, I will also present an extension of our study to finite temperatures both below and above the BEC phase transition of the bath. In particular, we find that many-body effects are suppressed as the temperature of the bath is increased, which can lead to counterintuitive narrowing of spectral features near the resonance.

References

Short bio (50 words) or link to website

2016-2020 University of Cambridge, BA, MSci Natural Sciences (Physics)
2020-2024 University of Cambridge, PhD with Zoran Hadzibabic (current position)
2024- I will be staying as a postdoc with Zoran from the autumn

Relevant publications (optional)

1. J. Etrych, G. Martirosyan, A. Cao, C. Ho, Z. Hadzibabic, and C. Eigen, Universal quantum dynamics of Bose polarons, arxiv.org/pdf/2402.14816
2. G. Martirosyan, C. J. Ho, J. Etrych, Y. Zhang, A. Cao, Z. Hadzibabic, and C. Eigen, Observation of Subdiffusive Dynamic Scaling in a Driven and Disordered Bose Gas, Phys. Rev. Lett. 132, 113401 (2024)
3. L. H. Dogra, G. Martirosyan, T. A. Hilker, J. A. P. Glidden, J. Etrych, A. Cao, C. Eigen, R. P. Smith, and Z. Hadzibabic, Universal equation of state for wave turbulence in a quantum gas, Nature 620, 521 (2023)

Career stage

Student

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Presenter: ETRYCH, Jiri (University of Cambridge)

Track Classification: FINESS