

Medium-enhanced repulsion between polaron quasiparticles in a quantum gas

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The problem of mobile quantum impurities immersed in a quantum gas [1] has attracted much attention recently owing to its clean realisation in cold atomic gases, as well as its relevance to a variety of systems spanning a range of energy scales, from semiconductors to neutron stars. Of particular interest is the interactions between polaron quasiparticles—impurities that are dressed by excitations of the surrounding gas—since this has ramifications for the phases of matter that emerge from such impurities. However, there is currently much debate about the nature of the interactions, with the latest experiments even disagreeing on the sign of the interaction strength [2,3].

In this talk, I will focus on bosonic impurities in a Bose-Einstein condensate and I will reveal that the medium actually enhances the existing repulsive interactions between the bosonic impurities. Furthermore, one can show that this is the *dominant* effect at zero temperature in the regime of weak interactions, in contrast to the prevailing wisdom in the field.

References

- [1] M.M. Parish and J. Levinsen, “Fermi polarons and beyond –Varenna lectures.” arXiv:2306.01215
- [2] C. Baroni et al., “Mediated interactions between Fermi polarons and the role of impurity quantum statistics.” Nature Physics 20, 68–73 (2024).
- [3] L. Tan et al., “Bose Polaron Interactions in a Cavity-Coupled Monolayer Semiconductor.” Phys. Rev. X 13, 031036 (2023).

Short bio (50 words) or link to website

Meera Parish is a Professor in theoretical physics and ARC Future Fellow at Monash University. Since obtaining her Ph.D. from the University of Cambridge, she has been a PCTS postdoctoral fellow at Princeton University, and a Lecturer and EPSRC research fellow at University College London.

Relevant publications (optional)

Career stage

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