



Contribution ID: 99

Type: **Focus session invited talk**

Quasiparticle interactions in quantum mixtures

Monday 1 December 2025 13:30 (30 minutes)

We investigate the fundamental problem of a small density of bosonic impurities immersed in a dilute Bose gas at zero temperature. Using a rigorous perturbative expansion, we show that the presence of the surrounding medium *enhances* the repulsion between dressed bosonic impurities (polarons) in the regime of weak interactions. Crucially, this differs from prevailing theories based on Landau quasiparticles, which neglect the possibility of quantum degenerate impurities and predict an exchange-induced attraction. We furthermore show that the polaron-polaron interactions are strongly modified if the medium chemical potential rather than the density is held fixed, such that the medium-induced attraction between thermal impurities becomes twice the expected Landau effective interaction. Our work provides a possible explanation for the differing signs of the polaron-polaron interactions observed in experiments across cold atomic gases and two-dimensional semiconductors, and it has important implications for theories of quasiparticles and quantum mixtures in general.

[1] J. Levinsen, O. Bleu, M. M. Parish, arXiv:2409.03406

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Session Classification: Focus Session: Ultra-cold atoms and quantum technology

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