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Towards Fermi polarons with heavy impurities

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The presented ultracold gases experiment uses bosonic ^{133}Cs and fermionic ^{6}Li. Because of their large mass ratio also qualitatively new observation become accessible. An example is the universal scaling law of Efimov states which has been investigated [1,2]. Currently, we are aiming for the creation of a Fermi polaron. In the infinitely heavy impurity limit the Fermi polaron loses is quasiparticle nature, which is known as the Anderson orthogonality catastrophe [3]. Since the chosen species are close to this limit, some precursors of this effect are predicted to arise [4,5]. For higher mass imbalance also the molecule-polaron crossover shifts to strong interactions which enriches the observable effects in this mixture [6,7,8].

In our apparatus a stable creation of a single species Fermi gas with $T/T_F \approx 0.2$ has been realized. We also set up a scheme with a sequential loading of the two species, which includes the movement of the Cs sample in a large optical dipole trap out of the center, to separate the preparation of the two components. Spectroscopic probes have been built up for ^{133}Cs (via a zero momentum Raman transition) as well as for ^{6}Li (using a radio frequency antenna). The combination of both spectroscopy methods allows for a direct distinction between molecules and polarons [9].

We will present the current status of the project at the time of the conference, which is expected to include a precise characterization of the sequential loading scheme as well as first spectroscopy signals of a degenerate gas with impurities.

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Short bio (50 words) or link to website

- B. Sc. (2018) and M.Sc. (2021) in physics: Karlsruhe (Germany); Bachelor and Master thesis: optical fiber-based micro resonators for quantum networking (Prof. David Hunger)
- since 2021: PhD student in Heidelberg (Germany). Ultracold mixture experiment with Lithium and Cesium to explore polaron physics (Prof. Matthias Weidemüller/Prof. Lauriane Chomaz)

Relevant publications (optional)

Career stage

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