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Fermi polarons in doped two-dimensional semiconductors

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The Fermi polaron, a particle dressed by excitations of a fermionic medium, has been extensively studied in ultracold atomic gases. Recently, it was realised that the optical response of doped atomically thin semiconductors also corresponds to a quantum impurity problem, where excitons are introduced into an electronic medium. I will discuss three scenarios where we have recently used cold-atom-inspired Fermi polaron theories to explain results in doped semiconductors. The first scenario involves applying the quantum virial expansion to describe photoluminescence [1]. The second scenario focuses on the observation that the relaxation from the repulsive to the attractive branch can be enhanced in doped semiconductors [2]. Finally, we will investigate how interactions between impurities may be probed using multidimensional spectroscopy [3]. These examples in turn have the potential to shed new light on the cold atom polaron problem.

[1] Mulkerin, Tiene, Marchetti, Parish, Levinsen, http://arxiv.org/abs/2212.05627

[2] Huang, Sampson, Ni, Liu, Liang, Watanabe, Taniguchi, Li, Martin, Levinsen, Parish, Tutuc, Efimkin, and Li, Phys. Rev. X 13, 011029 (2023)

[3] Muir, Levinsen, Earl, Conway, Cole, Wurdack, Mishra, Ing, Estrecho, Lu, Efimkin, Tollerud, Ostrovskaya, Parish, Davis, Nature Communications 13, 6164 (2022)

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