# Quadrupole interactions in an ultra-cold gas of fermions

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A novel type of interactions, namely quadrupolar long-range forces, can arise in an ultra-cold gas when atoms or molecules are prepared in a state with non-zero angular momentum in an applied electric field. Quadrupole-quadrupole interactions can lead to exotic many-body phases [1]. Promising candidates for such experiments are ultra-cold gases of ytterbium [2] and strontium [3] atoms.

In order to detect the presence of quadrupolar interactions, we propose to look at an ultracold gas in a pancake geometry. Here, we study the influence of the quadrupole-quadrupole interaction fermionic gas in a thin layer geometry. It is found that the energy shift and other physical quantities have a characteristic angular dependence on the direction of the electric field. This energy shift could be measurable as a clock shift in ytterbium, which has particularly well-suited transitions [2]. The results are also compared to the case of short-range interactions and with dipolar interactions [4].

References:

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