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Low-Dimensional Fermi Gases in Optical Lattices

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Optical lattices are a powerful tool to create novel many-body quantum systems with ultracold atoms. In particular, they allow to study low-dimensional quantum gases. A strongly interacting one-dimensional Fermi gas which we create in an optical lattice represents a realization of a tunable Luttinger liquid. We have observed two-particle bound states of atoms confined in a one- dimensional matter waveguide. These bound states exist irrespective of the sign of the scattering length, contrary to the situation in free space. In a spin-polarized Fermi gas interacting via a p-wave Feshbach resonance the strong confinement allows us to restrict the asymptotic scattering states. When aligning the spins along (or perpendicular to) the axis of motion in a 1D gas, scattering into channels with the angular momentum projection of $|m| = 1$ (or $m = 0$) can be completely suppressed.

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