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Strongly correlated fermionic gases in optical lattices

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In a solid material strong interactions between the electrons can lead to surprising properties. A prime example is the Mott insulator, where the suppression of conductivity is a result of interactions and not the consequence of a filled Bloch band. The proximity to the Mott insulating phase in fermionic systems is the origin for many intriguing phenomena in condensed matter physics, most notably high-temperature superconductivity. Fermionic quantum gases trapped in an optical lattice offer a very pure realisation of the Hubbard model, giving a new approach to understand the physics of strongly correlated systems.

After introducing fermionic atoms in optical lattices and outlining how they can be used to access the strongly interacting regime, I will focus on recent experiments in our group. In particular, I will report on the formation of a Mott insulor of repulsively interacting two-component Fermi gas, which we have recently observed.