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Quantum Gas Microscopy - a Close-Up of Entanglement, Quantum Statistical Physics and Fermions

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With quantum gas microscopy we are able to take the control of ultra cold quantum gases in an optical lattice to the next and ultimate level of high fidelity addressing, manipulation and readout of single particles. In my talk I will present experiments in which quantum gas microscopy allows us to directly measure entanglement entropy in a quantum many-body system. I will talk about the measurement of entanglement growth after a quench, which enables us to carry out experiments on the foundations of quantum statistical mechanics. Finally I will report on quantum gas microscopy of the Fermi-Hubbard model and the observation of several quantum phases.