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Trapping, cooling and probing fermionic atoms into the Mott and Neel states¹

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A new form of quantum condensed matter physics has emerged from the study of ultra-cold fermionic atoms in optical lattices. Experiments have recently reached the incompressible Mott regime. Detailed comparison to theory and computational studies at intermediate temperatures have validated the concept of optical lattice emulation of many-body fermionic systems. Cooling these systems deeper into the quantum degenerate regime, and devising new spectroscopic probes to investigate physical issues of interest such as quasiparticle properties, are key challenges in this context. The presentation will be based in part on the following references: L. De Leo, C.Kollath, A.Georges, M.Ferrero and O.Parcollet Phys. Rev. Lett. 101, 210403(2008); J.-S. Bernier et al. Phys. Rev. A 79, 061601 (2009); R. Jördens et al. Phys. Rev. Lett. 104, 180401 (2010); J.-S. Bernier et al., Phys. Rev. A 81, 063618 (2010); L. De Leo et al., arXiv:1009.2761

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