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Cooling Atomic Gases With Disorder[1]

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Cold atomic gases have proven capable of emulating a number of fundamental condensed matter phenomena including Bose-Einstein condensation, the Mott transition, Fulde-Ferrell-Larkin-Ovchinnikov pairing and the quantum Hall effect. Cooling to a low enough temperature to explore magnetism and exotic superconductivity in lattices of fermionic atoms remains a challenge. We propose a method to produce a low temperature gas by preparing it in a disordered potential and following a constant entropy trajectory to deliver the gas into a non-disordered state which exhibits these incompletely understood phases. We show, using quantum Monte Carlo simulations, that we can approach the Neél temperature of the three-dimensional Hubbard model for experimentally achievable parameters. Recent experimental estimates suggest the randomness required lies in a regime where atom transport and equilibration are still robust. Thereza Paiva, Ehsan Khatami, Shuxiang Yang, Valery Rousseau, Mark Jarrell, Juana Moreno, Randall G. Hulet, and Richard T. Scalettar, arXiv:1508.02613

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