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Fermions in 2D Optical Lattices: Temperature and Entropy Scales for Observing Antiferromagnetism and Superfluidity[1] THEREZA PAIVA, Universidade Federal do Rio de Janeiro, RICHARD SCALETTAR, University of California, Davis, MOHIT RANDERIA, NANDINI TRIVEDI, Ohio State University — One of the major challenges in realizing antiferromagnetic and superfluid phases in optical lattices is the ability to cool fermions. We determine constraints on the entropy for observing these phases in two-dimensional Hubbard models. We investigate antiferromagnetic correlations in the repulsive model at half filling and superfluidity of s-wave pairs in the attractive case away from half filling using determinantal quantum Monte Carlo simulations. We find that an entropy per particle ln(2) is sufficient to observe the charge gap in the repulsive Hubbard model or the pairing pseudogap in the attractive case. Observing antiferromagnetic correlations or superfluidity in 2D systems requires a further reduction in entropy by a factor of three or more. In contrast to higher dimensions, we find that adiabatic cooling is not useful to achieve the required low temperatures.

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