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Double occupancy as a universal probe for antiferromagnetic correlations and entropy in cold fermions on optical lattices NILS BLUEMER, ELENA GORELIK, DANIEL ROST, Institute of Physics, Johannes Gutenberg University, Mainz, Germany, THEREZA PAIVA, Instituto de Fisica, Universidade Federal do Rio de Janeiro, Brazil, RICHARD SCALETTAR, Department of Physics, UC Davis, USA, ANDREAS KLUEMPER, University of Wuppertal, Wuppertal, Germany — We study antiferromagnetic (AF) order and correlations in the half-filled Hubbard model using dynamical mean-field theory, determinantal quantum Monte Carlo (in dimensions $d = 2, 3$), and Bethe Ansatz (in $d = 1$). We establish a low-temperature enhancement of the double occupancy D at stromg coupling as a local probe of strong AF correlations accessible in cold-atom experiments [1]. As a function of entropy $s = S/(Nk_B)$, D is nearly universal with respect to dimensionality, with a minimum in $D(s)$ at $s \approx \log(2)$ [2]. The quantum AF Heisenberg regime at $s \lesssim \log(2)$, driven by an abrupt gain in kinetic energy and with clear signatures also in the next-nearest neighbor correlation function, should be in immediate experimental reach. Long-range order appears hardly relevant for the current search of AF signatures in cold fermions. Thus, experimentalists need not achieve $s < \log(2)/2$ (on a cubic lattice) and should consider lower dimensions, for which the AF effects are larger, or even use dimensionality as a tunable parameter.

[1] E. V. Gorelik, I. Titvinidze, W. Hofstetter, M. Snoek, and N. Blümer, Phys. Rev. Lett. **105**, 065301 (2010).
[2] E. V. Gorelik, T. Paiva, R. Scalettar, A. Klümper, and N. Blümer, arXiv:1105.3356v1.

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