Abstract Submitted
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The Mott-Hubbard Insulator: localization and topological quantum order[1] RICHARD M. MARTIN, University of Illinois at Urbana-Champaign and Stanford University — An insulating state of condensed matter is characterized by localization of the center of mass of the electrons. This criterion can be addressed in terms of the ground state on a torus with boundary conditions $\Psi_K(\{x_1 + L, x_2, \ldots\}) = exp(iKL)\Psi_K(\{x_1, x_2, \ldots\})$. As shown by Kohn[1], in an insulator the energy is insensitive to K as $L \to \infty$, whereas in an ideal metal it increases as K^2. In addition, Souza, et al. derived expressions for the localization length in terms of the wavefunction as a function of K. The present work generalizes the arguments to provide a fundamental distinction between "band" and "Mott-Hubbard" insulators. The criteria involve only counting of electrons and experimentally measurable quantities independent of models, and they lead to the requirement that a Mott-Hubbard insulator with no broken local symmetry must have topological quantum order.

[1] W. Kohn, Phys. Rev. 133, A171 (1964)
[2] I. Souza, et al., Phys. Rev. B 62, 1666 (2000).

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