

Abstract Submitted  
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**Quantitative determination of the Hubbard model phase diagram from optical lattice experiments: overcoming the singular nature of the thermodynamic limit** VIVALDO CAMPO, JR., Universidade de Brasilia, Brazil and Universidade de Sao Paulo, Brazil, KLAUS CAPELLE, Universidade de Sao Paulo, Brazil, JORGE QUINTANILLA, Rutherford Appleton Laboratory, U.K., CHRIS HOOLEY, University of St Andrews, U.K. — We propose an experiment to obtain the phase diagram of the fermionic Hubbard model, for any dimensionality, using cold atoms in optical lattices. It is based on measuring the total energy for a sequence of trap profiles. It combines finite-size scaling with an additional ‘finite-curvature scaling’ necessary to reach the homogeneous limit. We illustrate its viability in the 1D case, simulating experimental data in the Bethe-Ansatz local density approximation. Including experimental errors, the filling corresponding to the Mott transition can be determined with better than 3 per cent accuracy. The main obstacle that our method overcomes is the singular nature of the thermodynamic limit of atom traps. We discuss this surprising phenomenon and describe a simpler experiment that could be used to demonstrate it.

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