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Double occupancy as a probe of the Mott transition for fermions in one-dimensional optical lattices[1] JORGE QUINTANILLA, SEPnet, University of Kent and Rutherford Appleton Laboratory, VIVALDO L. CAMPO, JR, UFScar, Brazil, VITO SCAROLA, Virginia Tech, USA, CHRIS HOOLEY, SUPA and University of St Andrews, UK, KLAUS CAPELLE, UFABC, Brazil — We study theoretically double occupancy D as a probe of the Mott transition for trapped fermions in one-dimensional optical lattices and compare our results to the three-dimensional case. The ground state is described using the Bethe Ansatz in a local density approximation and the behavior at finite temperatures is modelled using a high-temperature series expansion. In addition, we solve analytically the model in the limit in which the interaction energy is the dominant energy scale. We find that enhanced quantum fluctuations in one dimension lead to increased double occupancy in the ground state, even deep in the Mott insulator region of the phase diagram. Similarly, thermal fluctuations lead to high double occupancies at high temperatures. Nevertheless, D is found to be a good indicator of the Mott transition just as in three dimensions. We discuss possible experiments to verify these results and argue that the one-dimensional Hubbard model could be used as a benchmark for quantitative quantum analogue simulations.

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Jorge Quintanilla
SEPnet, University of Kent and Rutherford Appleton Laboratory

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