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Solutions of the Two Dimensional Hubbard Model: Benchmarks and Results from a Wide Range of Numerical Algorithms

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In this talk we present numerical results for ground state and excited state properties (energies, double occupancies, and Matsubara-axis self energies) of the single-orbital Hubbard model on a two-dimensional square lattice. In order to provide an assessment of our ability to compute accurate results in the thermodynamic limit we employ numerous methods including auxiliary field quantum Monte Carlo, bare and bold-line diagrammatic Monte Carlo, method of dual fermions, density matrix embedding theory, density matrix renormalization group, dynamical cluster approximation, diffusion Monte Carlo within a fixed node approximation, unrestricted coupled cluster theory, and multireference projected Hartree-Fock. We illustrate cases where agreement between different methods is obtained in order to establish benchmark results that should be useful in the validation of future results.