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Phases of the two-leg Hubbard ladder in the large U limit LI LIU, HONG YAO, STEVEN KIVELSON, Stanford University, STEVEN WHITE, University of California, Irvine, DUNG-HAI LEE, University of California, Berkeley — We study the phase diagram of the two-leg Hubbard ladder in the large U limit using the density matrix renormalization group (DMRG). Already in the limit of infinite on-site repulsion U, we find a rich phase diagram in which commensurability effects are unexpectedly prominent: A fully spin-polarized "Nagaoka" metallic phase occurs for electron density, n, in the range $1 > n > n_1$, where $n_1 \approx 0.8$ is not obviously locked by any commensurability. There is an insulating, anti-ferromagnetic commensurate plaquette phase at n=3/4, and two-phase coexistence for $n_1 > n > 3/4$. For $3/4 > n > n_2 \approx 0.6$, there is a partially spin-polarized metallic state with a magnetization peak centered at n=2/3. For the most part, the ground state is a paramagnetic Luttinger liquid for $n_2 \geq n$, although an antiferromagnetic phase with a substantial charge gap (and which may or may not have a small spin-gap) arises at n=1/2. Interesting soliton excitations with fractional charge are found for the plaquette phase at n=3/4. We have also explored the evolution of these phases as a function of decreasing (but still large) U, both by studying the t-J model and of the underlying Hubbard model.

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