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The Bose-Fermi Hubbard model in the light and heavy fermion limits ALEXANDER MERING, DOMINIK MUTH, MICHAEL FLEISCHHAUER, Technical University of Kaiserslautern, Germany — We discuss mixtures of bosons and spin-polarized fermions in optical lattices in the limits of heavy and light fermions. The first case is mapped to a Bose-Hubbard system with binary disorder or a superlattice potential. Boundaries between Mott- insulating and compressible phases are determined analytically within an extended strong-coupling expansion. DMRG calculations reveal furthermore a novel phase with Bose-glass character. In the opposite limit of ultra-light fermions an effective boson Hamiltonian is derived with oscillatory long-range interactions leading to additional phases such as compressible density-waves. Analytic predictions for the CDW amplitude are made and compared to DMRG data. The numerical studies show furthermore that the CDW is always associated with exponential decay of bosonic correlations. Moreover, the CDW phase has a very slow crossover into a Luttinger liquid phase.

Alexander Mering
Technical University of Kaiserslautern, Germany

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