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Ground State Phase Diagram of the Two-Component Bose-Hubbard Model SEBNEM GUNES SOYLER, Department of Physics, University of Massachusetts, Amherst, BARBARA CAPOGROSSO-SANSONE, Institute for Theoretical Atomic, Molecular and Optical Physics, Harvard-Smithsonian Center of Astrophysics, NIKOLAY PROKOF'EV, BORIS SVISTUNOV, Department of Physics, University of Massachusetts, Amherst — We have performed path integral Monte Carlo simulations of the two-component hard-core Bose-Hubbard model on a square lattice at half-integer filling factor for each component. This system can be realized experimentally with heteronuclear bosonic mixtures in optical lattices with tunable interspecies interactions. Our results disagree with preexisting analytical treatments both quantitatively and qualitatively. We reveal the existence of an additional solid+superfluid phase for strong anisotropy between the hopping amplitudes which radically changes the topology of the ground-state phase diagram. The new phase is a direct consequence of effective interactions between "heavy" atoms mediated by the "light" superfluid component. Remarkably, mediated interactions are sign-alternating and thus lead to a rich variety of yet to be discovered quantum phases.

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