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Bose metals on multi-leg ladders with ring-exchange RYAN V. MISHMASH, UCSB, MATTHEW S. BLOCK, UCSB and UK Lexington, RIBHU K. KAUL, UK Lexington, D.N. SHENG, CSU Northridge, OLEXEI I. MOTRUNICH, Caltech, MATTHEW P.A. FISHER, UCSB — Accessing non-superfluid, uncondensed phases of 2D lattice bosons that conduct and break no symmetries has traditionally been very difficult. Here, we present recent work establishing compelling evidence for the stability of quasi-1D descendants of a particular example of such a "Bose metal." Specifically, we focus on the so-called "d-wave Bose metal" (DBM), which is crucially characterized by surfaces of gapless excitations in momentum space. Motivated by a strong-coupling analysis of the gauge theory for the DBM, we study in detail a model of hard-core bosons moving on the four-leg ladder with frustrating four-site ring exchange. In this system, we have successfully identified a compressible gapless Bose metal phase with five gapless modes, one more than the number of legs [1]. We can understand the nature of this phase using slave-particle-inspired determinantal wave functions, the properties of which compare impressively well to a DMRG solution of the model Hamiltonian. This represents a significant step forward in establishing the stability of the DBM in two dimensions. Finally, we will discuss scenarios in which such Bose metal-type phases may be realized in present-day experiments on ultracold atomic gases.

[1] R. V. Mishmash et al., PRB 84, 245127 (2011).

Ryan Mishmash
UCSB

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