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Exotic gapless Bose metals and insulators on multi-leg ladders RYAN V. MISHMASH, MATT S. BLOCK, UCSB, RIBHU K. KAUL, UK, Lexington, DONNA N. SHENG, CSU, Northridge, OLEXEI I. MOTRUNICH, Caltech, MATTHEW P.A. FISHER, UCSB — We present recent work establishing compelling evidence for the existence of quasi-1D descendants of the d-wave Bose liquid (DBL), a novel 2D quantum phase of itinerant bosons first discussed in [1]. In particular, we study a model of hard-core bosons moving on the N-leg ladder square lattice with frustrating four-site ring exchange. In this talk, we focus on two novel phases: an incompressible gapless Mott insulator on the 3-leg ladder and a compressible gapless Bose metal on the 4-leg ladder. The former is a fundamentally quasi-1D phase that is insulating along the ladder but has two 1D gapless modes and power law transverse density-density correlations at incommensurate wave vectors; extensions of this phase to full 2D will be discussed. The latter, on the other hand, is conducting along the ladder and has five 1D gapless modes, one more than the number of legs; this represents a significant step forward in establishing the existence of the DBL in two dimensions. In both cases, we can understand the nature of the phase using slave-particle-inspired variational wave functions consisting of a product of two distinct Slater determinants, the properties of which compare impressively well to a DMRG solution of the model Hamiltonian. [1] O. I. Motrunich and M. P. A. Fisher, PRB **75**, 235116 (2007).

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