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Strong-coupling theory approach to describe an atomtronic josephson junction on an optical lattice MANJARI GUPTA, H.R. KRISHNAMURTHY, Center For Condensed Matter Theory, Department of Physics, Indian Institute of Science, Bangalore 560012, India, J.K. FREERICKS, Department of Physics, Georgetown University, Washington, D.C. 20057, USA — We examine the behavior of a bose superfluid on an optical lattice in the presence of an annular trap and a barrier across the annular region which acts as a Josephson junction. As the superfluid is rotated it moves with a supercurrent until it develops phase slips which generate vortices. We use a finite temperature strong-coupling (t/U) expansion about the mean-field solution of the Bose Hubbard model, as described in our earlier paper Ref. [1], to characterize the device. Although our formalism is in equilibrium, it allows us to study the superfluid current flow and the generation of phase slips. This theory should aid in the further development of atomtronic circuits ([2], [3]). In addition, we show how even more complex Josephson junction structures spontaneously arise if the filling is increased to generate Mott regions within the system.

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