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Spin models for two-site resonant tunnelling dynamics of bosons in a tilted optical lattice ANTON BUYSKIKH, Department of Physics and SUPA, University of Strathclyde, Glasgow G4 0NG, UK, DAVID PEKKER, Department of Physics and Astronomy, University of Pittsburgh, PA 15260, USA, ANDREW DALEY, Department of Physics and SUPA, University of Strathclyde, Glasgow G4 0NG, UK — We study the non-equilibrium dynamics of a one dimensional tilted Bose-Hubbard model, beginning from unit filling in the Mott insulator regime. Studying a quench to the resonance point for tunnelling of the particles over two sites, we show how in the presence of a superlattice, a spin model emerges involving two subchains described by an Ising model that are then coupled by interaction terms. Using this model, we study the behaviour of the system near the quantum critical point in the vicinity of the tunnelling resonance, especially looking at the out-of-equilibrium dynamics after the quench. We compare the dephasing of local observables corresponding to the number of doubly occupied sites, which were measured in recent experiments, to the dynamics expected in the presence of noise and decoherence. These results should be directly measurable in experiments, and provide a diagnostic tool for investigating decoherence in such out-of-equilibrium dynamics.

Anton Buyskikh
Department of Physics and SUPA, University of Strathclyde, Glasgow G4 0NG, UK

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