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Spin dynamics with bosons in tilted optical lattices ANDREW DALEY, ANTON BUYSKIKH, LUCA TAGLIACOZZO, Department of Physics and SUPA, University of Strathclyde, Glasgow G4 0NG, UK, DAVID PEKKER, Department of Physics and Astronomy, University of Pittsburgh, Pittsburgh, PA 15260, USA, CHRIS HOOLEY, SUPA, School of Physics and Astronomy, University of St Andrews, St Andrews KY16 9SS, UK, DIRK SCHURICHT, Institute for Theoretical Physics, Center for Extreme Matter and Emergent Phenomena, Utrecht University, Utrecht, The Netherlands — In recent years, several experiments have realised interesting many-body phenomena with bosonic atoms in tilted optical lattices. This especially includes resonant tunneling dynamics when the on-site interaction shift for two atoms is approximately an integer multiple of the energy offset between neighbouring sites. We show that near the two-site resonance in such experiments, the dynamics can be described by a spin model that maps onto coupled Ising chains. This system exhibits unusual behaviour both out of equilibrium, and in its critical behaviour near the tunnelling resonance point. We discuss the resulting many-body physics, and possibilities to observe the corresponding phenomena in experiments. One of the special properties of such systems is that very sensitive phenomena are often more accessible than in homogeneous systems, because entropy in the initial atomic state maps to small amounts of localised disorder in the spin model, leaving the initial state in that system much closer to zero-temperature.

Andrew Daley
Univ of Strathclyde, Glasgow, UK

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