Non-linear excitations and low-energy effective theories of spinor gases far from equilibrium

Ido Siovitz, Yannick Deller, Alexander Schmutz, Helmut Strobel, Markus K. Oberthaler, and Thomas Gasenzer

Kirchhoff Institute for Physics, University of Heidelberg, Im Neuenheimer Feld 227, 69120, Heidelberg, Germany

A system driven far from equilibrium via a parameter quench can show universal dynamics, characterized by self-similar spatio-temporal scaling, associated with the approach to a non-thermal fixed point. Non-linear excitations such as solitons or vortices play a key role in the time evolution of such systems. Here we present a derived low-energy effective theory for an ultracold spin-1 gas, in addition to outlining the range of non-linear phenomena within this framework that impact the scaling behavior of the spinor gas. We also showcase experimental measurements of such excitations and discuss the real-time confinement dynamics of these excitations.