Quantum friction effects in superfluids

Low-temperature ordered states of matter with spontaneously broken symmetry host collective excitations - Goldstone modes - that are coupled to the order parameter field. The collective excitations act on the order parameter as a thermal bath and give rise to its non-trivial dynamics that include effects like "quantum friction," a stochastic Langevin force and effective Brownian motion. In this talk, I will discuss new theoretical and experimental results and ideas on such quantum friction effects in superfluids and magnetic systems. In the first part of my talk, I will focus on quantum dynamics of topological textures, in particular solitons/domain walls, propagating in low-dimensional superfluids/magnets. An effective quasi-classical equations of motion will be derived. It will be shown that interestingly the familiar Ohmic friction is absent in the integrable setup, but the equations contain non-Markovian dissipative forces [1]. I will explain a way to restore and control the Ohmic friction force and related Brownian motion of topological textures, as was demonstrated in a recent experiment [2].

References: