

L. Cugliandolo, LPTHE, Université Pierre et Marie Curie, Paris, France

From non equilibrium quantum Brownian motion to impurity dynamics in exotic quantum liquid baths

Motivated by recent experiments on impurity motion in one dimensional ultra cold quantum liquids we derive the generating functional for all non equilibrium correlation functions of a quantum Brownian particle coupled to a quantum bath of harmonic oscillators. With our new method we investigate three problems of current interest: the slow relaxation dynamics of a particle confined in a harmonic potential after a position measurement; the relaxation dynamics of a particle trapped in a harmonic potential after a quantum quench realized as a sudden change in the potential parameters; the evolution of an impurity in contact with a one dimensional bosonic quantum gas. The latter problem has been recently realized in experiments with cold atoms. By using the Luttinger-Tomonaga theory we show that the quantum gas is equivalent to an exotic quantum bath of harmonic oscillators with intriguing features. The remarkable similarity between our theoretical results and experimental data is discussed.