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Static and dynamic properties of a one-dimensional mobile impurity (ONSITE presentation)

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A single impurity particle in an ultracold atomic gas is a prospective model for probing relaxation dynamics of an interacting out-of-equilibrium quantum system. I will focus on McGuire's model that describes an impurity that propagates in a one-dimensional gas of free fermions. It is the simplest and yet fundamental model capturing the peculiar physics and mathematics of the non-equilibrium processes. The integrability of the model allows one to obtain a complete nonperturbative solution and express physical quantities in terms of the Fredholm determinants. After a detailed analysis of these determinants, I will discuss several striking physical phenomena such as incomplete relaxation and momentum-dependent impurity statistics. The universal properties of such one-dimensional systems can be described by the nonlinear Luttinger liquid (nLL). I will explain the microscopic derivation of nLL from the form-factors and discuss the generalization to finite temperatures.

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