Formation probabilities, Post-measurement entanglement entropy and Casimir effect

M.A. Rajabpour

Instituto de Fisica Universidade Federal Fluminense Niteroi, RJ, Brasil

To discuss different properties of a quantum system it is customary to use energy basis. This is mostly because the evolution of the system looks much more simple in this basis. In addition the Hamiltonian plays an important role in the equilibration properties of a quantum system. A great deal of universal properties can be studied in the energy basis. However, in this talk I would like to study a quantum system in local configuration bases. I will show that by studying a quantum system in local basis one can extract a lot of universal properties. I will first introduce formation probability as a quantity which can determine the universality class of a quantum critical system. In other words, by calculating this quantity one can find the central charge and critical exponents of a quantum system and determine the universality class uniquely. I will show that calculating this quantity boils down to finding Casimir energy of two needles. Then using boundary conformal field theory (BCFT) techniques we find exact results for the formation probabilities. Numerical results for transverse field Ising model will be presented to support the analytical results. Then we will briefly talk about Shannon mutual information as another quantity which can play similar role. We will present a conjecture which connects Shannon mutual information to the central charge of the underlying conformal field theory. We will support the conjecture with many numerical calculations. Finally, we will introduce post-measurement entanglement entropy as a tripartite measure of entanglement. We will show that this quantity is related to the Casimir energy of needles on Riemann surfaces and can be calculated exactly for conformal field theories. To do that we use a slightly different method than twist operator technique. Many analytical results, such as, Renyi entropy, entanglement Hamiltonian, distribution of the eigenvalues of entanglement Hamiltonian, the effect of the boundary and Affleck-Ludwig boundary entropy can be discussed naturally in our framework. Few numerical results regarding free bosons and transverse field Ising chain will be presented as support for analytical results.

[l] M.A. Rajabpour, EPL **112**, 66001 (2015).
[2] M.A. Rajabpour, PRB **92**, 075108 (2015).
[3] M.A. Rajabpour, JSTAT **063109**, 00 (2016).
[4] M.A. Rajabpour and K. Najafi, PRB **93**, 125139 (2016).
[5] M.A. Rajabpour and K. Najafi, JHEP **12**, 124 (2016).