The Generalized Gibbs Ensenble in the Heisenberg spin chain: A Hilbert space Monte Carlo approach

Vincenzo Alba[1] and Maurizio Fagotti[2]

[1]*International School for Advanced Studies (SISSA), Via Bonomea 265, 34136, Trieste, Italy, INFN, Sezione di Trieste*
[2]*Département de Physique, Ecole normale superieure, CNRS, 24 rue Lhomond, 75005 Paris, France*

(Dated: June 12, 2015)

I. INTRODUCTION

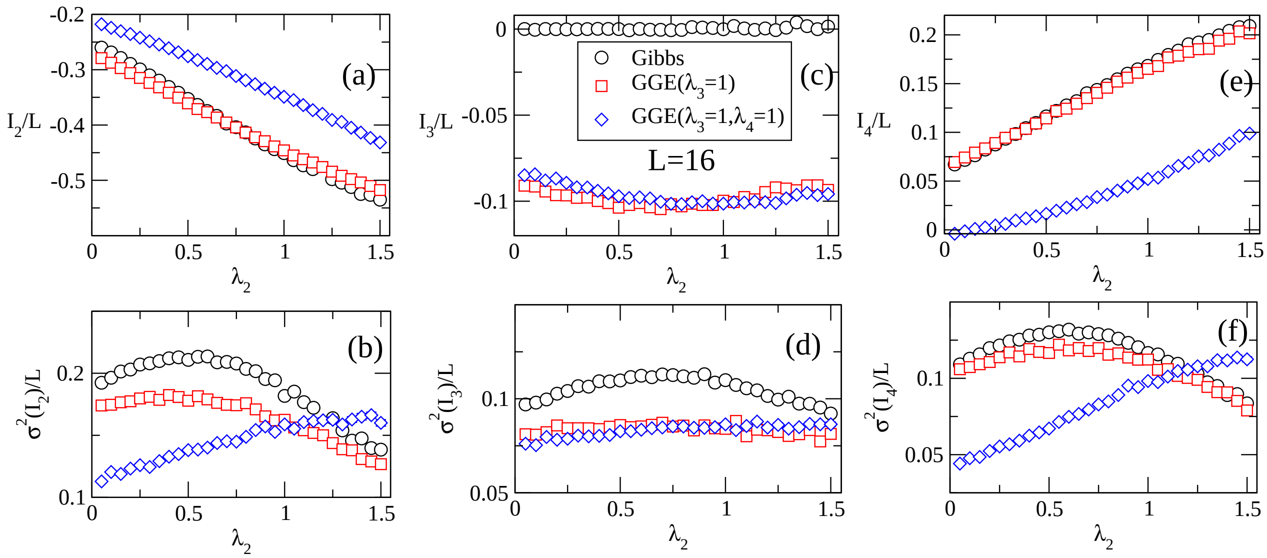

FIG. 1. The Generalized Gibbs Ensenble (GGE) in the Hisenberg spin chain of length $L = 16$. The GGE is obtained including the first three non-trivial conserved quantity I_2, I_3, I_4. Here I_2 is the Hamiltonian. The corresponding Lagrange multipliers are denoted as $\lambda_2, \lambda_3, \lambda_4$, with λ_2 being the inverse temperature $\lambda_2 = \beta$. In all the panels circles, squares, and rhombi correspond to the the situations with $\lambda_3 = \lambda_4 = 0$ (i.e., the Gibbs ensenble), $\lambda_3 = 1, \lambda_4 = 0$, and $\lambda_3 = \lambda_4 = 1$. (a)(b) The GGE expectation value of I_2/L using the GGE ensemble and the corresponding fluctuations $\sigma^2(I_2)/L$, plotted as function of $0 \leq \lambda_2 \leq 1.5$. (c)(d) and (e)(f): Same as in (a)(b) for I_3 and I_4, respectively. The continuous lines are the analytical results in the thermodynamic limit using the Generalized Thermodynamic Bethe Ansatz (GTBA) approach (**to be provided by Maurizio**).

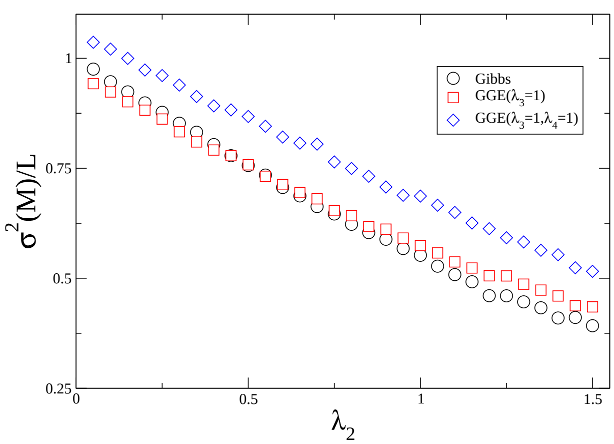

FIG. 2. The Generalized Gibbs Ensenble (GGE) in the Hisenberg spin chain of length $L = 16$. The GGE is obtained including the first three non-trivial conserved quantity I_2, I_3, I_4. Here I_2 is the Hamiltonian. The corresponding Lagrange multipliers are denoted as $\lambda_2, \lambda_3, \lambda_4$, with λ_2 being the inverse temperature $\lambda_2 = \beta$. In all the panels circles, squares, and rhombi correspond to the the situations with $\lambda_3 = \lambda_4 = 0$ (i.e., the Gibbs ensemble), $\lambda_3 = 1, \lambda_4 = 0$, and $\lambda_3 = \lambda_4 = 1$. The GGE expectation value for the fluctuations of the total magnetization M, plotted as a function of λ_2.

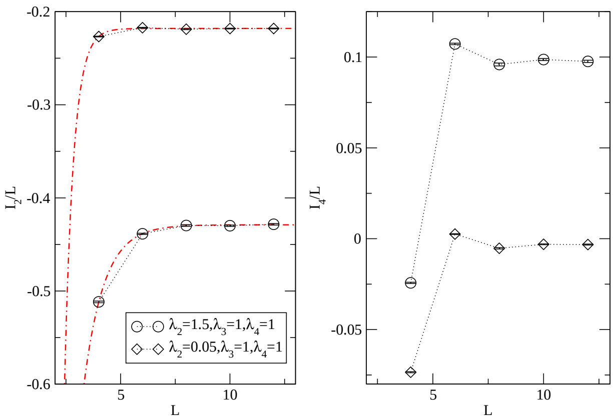

FIG. 3. The Generalized Gibbs Ensenble (GGE) in the Hisenberg spin chain of length $L = 16$. The GGE is obtained including the first three non-trivial conserved quantity I_2, I_3, I_4. Here I_2 is the Hamiltonian. The corresponding Lagrange multipliers are denoted as $\lambda_2, \lambda_3, \lambda_4$, with λ_2 being the inverse temperature $\lambda_2 = \beta$. In all the panels circles, squares, and rhombi correspond to the the situations with $\lambda_3 = \lambda_4 = 0$ (i.e., the Gibbs ensenble), $\lambda_3 = 1, \lambda_4 = 0$, and $\lambda_3 = \lambda_4 = 1$. The GGE expectation value for the fluctuations of the total magnetization M, plotted as a function of λ_2.