

Project: Symplectic tomography of 1D many-body systems

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Within the quantum symplectic tomography scheme, the real positive marginal distribution for measurable observables, such as rotated shifted and squeezed quadratures, determine completely the quantum states [’96 PLA Mancini, Man’ko, Tombesi; 02 JPA Man’ko, Man’ko, Marmo]. Such representation allows to smoothly extrapolate between local and non-local correlation functions of relevance to current experiment with ultracold gases in tight-waveguides [’04 Science Weiss, ’04 Nature Bloch, ’06 Nature Weiss]. With this objective, we introduce the reduce quantum tomograms for effectively one dimensional many-body quantum systems, and concentrate on the single-particle reduced tomogram (SPRT) whose marginals are the density profile and momentum distribution. Making use of the expansion of the reduced density matrix in terms of natural orbitals we shall find a diagonal representation of the SPRT. To illustrate the theory we will provide analytic symplectic tomograms for the one dimensional finite coupling delta function Bose gas exactly solvable by coordinate Bethe Ansatz [’63 PR Lieb, Liniger; ’07 PRA Forrester] and impenetrable bosons whose density matrix can be found in terms of a certain Painleve VI trascendent [’03 Forrester]. We will also present an operational approach to measure the SPRT. Adolfo del Campo will be benefited from additional collaboration with Prof. Vladimir Man’ko who will be hosted by Prof. Giuseppe Marmo during the dates of the stay and is involved in the present project as well.

The aim of the visit is to finish a first draft on this project and if time allows to extend the formalism in view of the possible generalization to particles with internal structure subjected to finite interactions solved by Algebraic Bethe ansatz or its limiting cases, exactly solvable making use of the Bose-Fermi duality, such as the generalized Tonks-Girardeau gas [’07 PRA del Campo, Muga, Girardeau; ’07 Mousavi, del Campo, Lizuain, Muga].

Host

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