MISGAM - Short Visit Grant- 2116

Visitor

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As mentioned in the application project, the purpose of my visit (11-17 November) at the Dipartimento di Scienze Fisiche at the Università di Napoli "Federico II" was to study the symplectic tomography [1] of ultracold atoms in tight waveguides [2]. My stay, aimed to collaborate with Prof. Giuseppe Marmo, coincided with the visit of Prof. Vladimir I. Man'ko (Lebedev Physical Institute, Russia), who is a leading expert in symplectic tomography and contributed to the development of the project as well.

During the visit we introduced the reduced symplectic tomography of effectively one-dimensional many-body quantum gases, which by performing a rotation in phase space, allows an smooth extrapolation between the (local) density profile and the (non-local) momentum distribution. Particular examples were considered such as ideal Bose, Fermi gases as well as interacting Lieb-Liniger [3] and Tonks-Girardeau [4] systems.

In addition, an operational approach was elucidated to experimentally measure the symplectic tomogram, namely, by suddenly shutting off the interactions and registering the time evolution of the density profile in a variety of situations: free expansion, expansion under gravity, and periodic motion in a harmonic trap. The one-body density matrix of the state in the trap can then be reconstructed. I consider this the main scientific result of the stay.

As for the results, we plan to submit them for publication in the following weeks. We have indeed nearly finished the draft "Symplectic tomography pf ultracold gases in tight-waveguide".

Finally, working with both Prof. Giuseppe Marmo and Prof. Vladimir I. Man'ko on the operational approach to quantum tomography in the affine invariant form, a more general scheme was unveiled for the reconstruction of an an arbitrary one-particle operator symbol [5, 6]. Further collaboration is expected in this line.

References

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[5] O. V. Man'ko, V. I. Man'ko, and G. Marmo J. Phys. A **35** 699 (2002)

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