



PhD Position 2023-2026:

*Exploring the optimal control of Bose-Einstein-Condensates:  
A challenge in Quantum Technologies*

A PhD position is opened at the University of Bourgogne in Dijon in the framework of an ANR research project on the control of Bose-Einstein-Condensates (BEC). This position, which will be advised by Pr. D. Sugny, is part of a general joint research project between the theoretical group of Pr. D. Sugny (Laboratoire Interdisciplinaire Carnot de Bourgogne, Université de Bourgogne, France) and the experimental group of Pr. D. Guéry-Odelin (Laboratoire de Collisions-Agrégats-Réactivité, University of Toulouse, France). Interdisciplinary collaborations in the field of applied Mathematics and computer science will be also involved during the position.

The goal of the research project is to develop quantum optimal control techniques and to investigate their experimental implementations in BEC experiments. Particular emphasis will be placed on applications in quantum simulation, sensing and computing. Within experimental facilities in the Toulouse's group, one major objective of the student will be to find numerically computed control fields that meet experimental constraints and limitations in order to demonstrate the potential of this approach. A first step has been made in 2021 in this direction by the consortium with the design of a BEC printer (see the enclosed figure). Arbitrary phase space distributions such as squeezed states have been generated recently (New J. Phys. 25 013012 (2023)). This research project will cover aspects of geometric and numerical optimizations, computational and theoretical physics, but will also have a strong interaction with experimentalists working in quantum technologies.

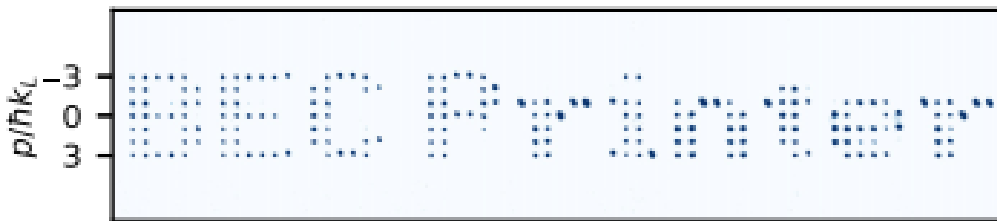


Fig.: Illustration of an experimental BEC dot Printer (PRX Quantum 2, 040303 (2021))

Applicants must hold a Master's Degree or equivalent in Theoretical physics, Mathematics or Engineering. Some background in quantum systems and nonlinear classical dynamics is expected but not mandatory. A scientific interest in computational physics will be very helpful. Good English skills are required. Applicants should provide an application letter, their CV (including a complete list of exams and corresponding grades) and Master's Thesis, and names (with email-addresses) of at least two additional references. All documents should be sent as a pdf file via e-mail to Pr. D. Sugny.

Pr. Dominique Sugny

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