Project 4.24. Ultra-cold atomic gases in optical lattices (theoretical)

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Unit: ON5

www: https://sites.google.com/site/ewiitk/

Background:

The physics of ultra-cold atomic gases is a rapidly developing field mainly because of extraordinary control over the system parameters that are achieved experimentally. It is also a reason why this many-body quantum system is thought and applied as a very sensitive sensor in quantum metrology or quantum simulators. In particular, ultra-cold atoms loaded into a periodic optical lattice potential are very promising in practical applications. A great example are optical clocks that are now operating with extreme precision. It is now commonly understood that squeezed and some entangled states can enhance precision. Additionally, they are also useful for testing the basics of quantum mechanics, e.g. in quantum information. The motivation for the research proposed is the recent discovery of squeezed and entangled states in the system and weakness of the present-day description.

Aim:

The project aims at performing a comprehensive theoretical study of the generation of squeezed and entangled states with ultra-cold atoms loaded into an optical lattice potential, for both bosons and fermions, taking into account the role of reduced spatial dimensions and decoherence. The project will be performed in close collaboration with other theoretical groups from IP PAS, Warsaw.

Requirements:

-good knowledge of quantum physics, previous experience with ultra-cold gases or quantum optics will be an advantage
-good numerical skills and willingness to learn new computational techniques
-good spoken and written English

Funding:

Standard Polish PhD scholarship. A supplement to the scholarship is also possible due to participation in scientific grants.

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