Project 4.7. Ultra-cold atomic gases in optical lattices (theoretical)

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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 fermions loaded into an optical lattice potential taking into account the role of reduced spatial dimensions and decoherence. he project will be performed in close collaboration with the group of prof. G. Juzeliūnas from Vilnius University and 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:

Scholarship: grant funding of 5000 PLN per month, before subtracting obligatory employer and employee social security contributions (~15%), for 36 months. Afterwards, standard Polish PhD scholarship (about 3240 PLN/month net in year 4).

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