Research Interest May 2017

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My research interests are Bose-Einstein Condensation, Dynamical Casimir effect, Optical Lattices and *PT* -symmetric quantum mechanics.

In the context of my master thesis, we investigate Dynamical Casimir Effect for different geometries. The resonant scalar particle generation for a swinging cavity resonator in the Casimir vacuum is examined. It is shown that the number of particles grows exponentially when the cavity rotates at a specific external frequency. The generation of photons in a three-dimensional rectangular cavity with two moving boundaries is also studied by using the multiple scale analysis (MSA). It is shown that the number of photons are enhanced for the cavity whose walls oscillate symmetrically with respect to the center of the cavity. The nonstationary Casimir effect is also discussed for the cavity which oscillates as a whole.

In the context of my Ph.D thesis, we studied ultracold gases. We investigate fast frictionless expansion for growing Bose–Einstein condensates described by the Gross–Pitaevskii gain equation. We show that fast frictionless expansion can be generalized to a condensate continuously replenished by pumping from the reservoir. We apply our formalism to the harmonically trapped condensate and an optical lattice.

My researches continue with *PT* -symmetric quantum mechanics. We study Super Bloch oscillation in a PT symmetric system. Wannier–Stark ladder in a PT symmetric system is generally complex that leads to amplified/damped Bloch oscillation. We show that a non-amplified wave packet oscillation with very large amplitude can be realized in a non-Hermitian tight binding lattice if certain conditions are satisfied. We show that pseudo PT symmetry guarantees the reality of the quasi energy spectrum in our system.