

Dear members of the Admissions Committee,

I would like to nominate myself for the Skoltech PhD Program in physics.

I obtained the master's degree in Physics from the Moscow State University. My curriculum was composed of intensive courses of both theoretical and experimental disciplines, including Quantum Mechanics, Optics, Thermodynamics, Statistical Physics, Solid-State Physics, as well as Applied Physics, the basics of Engineering Physics and Experimental Methods of Physical Research. I believe that the Skoltech PhD program, which ensures the application of theoretical and experimental approaches to the cutting-edge research, can be a great continuation for my professional training. Two research directions I am especially interested in are (1) application of numerical and computer algebra methods to problems in condensed matter physics and (2) quantum information theory.

In 2016 I started to work under the supervision of Oleg Lychkovskiy who is currently a Senior Research Scientist at Center in Photonics and Quantum Materials of Skolkovo Institute for Science and Technology. I analyzed the geometry of the spaces of symmetric states of a number of few-spin systems and calculated ground state energies of spin lattices. Some of the results of this research are published in the article

N. Il'in, E. Shpagina, F. Uskov, O. Lychkovskiy, A parameterization of constrained and unconstrained sets of quantum states, J. Phys. A: Math. Theor. 51, 085301 (2018).

Other results are currently prepared for publication. In connection with this work I wrote computer library for working with scalar and mixed products of Pauli matrices, and shared it on github.

The results of our research are also reported in my master thesis entitled "Spin $\frac{1}{2}$ systems with isotropic Heisenberg interaction: density matrix parameterization, variational principle, exact diagonalization." My thesis was awarded one of the 3rd places in competition of theses on faculty of physics of the Moscow State University.

In addition, I got the experience of participation in conferences. In 2017 I presented our results at the XIth International Conference on Quantum Optics and Quantum Information in Minsk and at the 60th all-Russian scientific conference of the Moscow Institute of Physics and Technology in Dolgoprudny.

Currently I participate in the Oleg Lychkovskiy's project "Quantum adiabaticity in many-body systems" supported by the Russian Science Foundation, and work at the Skoltech in the position of research intern. I was fortunate to attend numerous public lectures and seminars held in Skoltech, which greatly contributed to my educational background.

To conclude, I believe that I fulfill the criteria for the admission to the Skoltech PhD program. I will be glad to join Skoltech and contribute to its scientific excellence. I sincerely thank you for considering my application.

Respectfully yours,

Filipp Uskov.