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On the coexistence of Landau levels and superconductivity

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Curriculum Vitæ

I was born on 23rd of June 1993, in Otwock, Poland. Most of my youth I lived in Marki, where I attended the primary school. There I became interested in programming, which was a passion that I developed further in Władysław IV Secondary School in Warsaw, becoming a laureate of several national competitions. After graduating, I continued my education in Stanisław Staszic High School in Warsaw, where my main focus became physics. I obtained the laureate title of the national Physics Olympiad three times, having finished first and third on two of the occasions. This allowed me to participate in the International Physics Olympiads, in which I won a gold and a bronze medal.

In 2012 I entered the individual program of the bachelor's studies in physics at the University of Warsaw, in which I graduated with distinction in 2014 with a thesis titled *Electronic, magnetic and transport properties of zigzag graphene nanoribbon p - n junctions* under the supervision of professor Jacek Majewski. I continued my education on the master's program in physics at the same university, graduating with distinction in 2017 with a thesis *Thermal conduction and shot noise of Majorana surface states*, under the supervision of professor Jakub Tworzydło. During my studies I did a month-long internship in CERN within the COMPASS experiment. I also participated in the International Physicists' Tournament, in which our team earned the second place twice.

In 2017 I began my PhD studies at the Instituut-Lorentz of Leiden University in the Netherlands, under the supervision of professor Carlo Beenakker. My research was focused on the properties of topological materials, in particular Weyl and p -wave superconductors. I have attended several international schools and conferences, during which I had the opportunity to present the results of my research both orally and in a poster. During my studies I assisted with courses in Quantum Theory and Quantum Information, for which I was awarded the Teaching Assistant Prize.

After receiving my PhD diploma, I plan to continue my career in physics, studying further implications of the findings described in this thesis, as well as other novel phenomena in condensed matter.

List of publications

- N. V. Gnezdilov, M. Diez, M. J. Pacholski, and C. W. J. Beenakker, *Wiedemann-Franz-type relation between shot noise and thermal conduction of Majorana surface states in a three-dimensional topological superconductor*, Physical Review B **94**, 115415 (2016).
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- Ī. Adagideli, F. Hassler, A. Grabsch, M. J. Pacholski, and C. W. J. Beenakker, *Time-resolved electrical detection of chiral edge vortex braiding*, SciPost Physics **8**, 013 (2020).
- G. Lemut, M. J. Pacholski, O. Ovdar, A. Grabsch, J. Tworzydło, and C. W. J. Beenakker, *Localization landscape for Dirac fermions*, Physical Review B **101**, 081405 (2020).
- M. J. Pacholski, C. W. J. Beenakker, Ī. Adagideli, *Universal chiral magnetic effect in the vortex lattice of a Weyl superconductor*, Annals of Physics **417**, 168103 (2020). [Chapter 4]
- F. Hassler, A. Grabsch, M. J. Pacholski, D. O. Oriekhov, O. Ovdar, Ī. Adagideli, and C. W. J. Beenakker, *Half-integer charge injection by a Josephson junction without excess noise*, Physical Review B **102**, 045431 (2020).
- G. Lemut, A. Donís Vela, M. J. Pacholski, J. Tworzydło, and C. W. J. Beenakker, *Magnetic breakdown spectrum of a Kramers-Weyl semi-metal*, New Journal of Physics **22**, 093022 (2020).

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- M. J. Pacholski, G. Lemut, O. Ovdat, Ī. Adagideli, and C. W. J. Beenakker, *Deconfinement of Majorana vortex modes produces a superconducting Landau level*, Physical Review Letters **126**, 226801 (2021). [Chapter 5]
- M. J. Pacholski, G. Lemut, J. Tworzydło, and C. W. J. Beenakker, *Generalized eigenproblem without fermion doubling for Dirac fermions on a lattice*, arXiv:2103.15615 (2021). [Chapter 6]
- A. Donís Vela, G. Lemut, M. J. Pacholski, C. W. J. Beenakker, *Chirality inversion of Majorana edge modes in a Fu-Kane heterostructure*, arXiv:2105.04433 (2021).
- G. Lemut, M. J. Pacholski, C. W. J. Beenakker, *Chiral charge transfer along magnetic field lines in a Weyl superconductor*, arXiv:2106.12327 (2021).