On topological properties of massless fermions in a magnetic field

Lemut, G.

Curriculum Vitæ

I was born on the 14th of December 1994, in Postojna, Slovenia and grew up in a small village outside of Ajdovščina. During my primary school, I quickly became interested in mathematics, physics and astronomy. With the help of my motivating teachers, I continued this passion throughout my high school, where I competed in various national competitions and joined a local astronomical society.

In 2013, I began my Bachelor's studies in Physics at the University of Ljubljana, where I discovered my interest for theoretical physics, in particular the field of condensed matter physics. Outside of classes, I pursued astrophotography and continued to assist with astronomy camps for kids and students.

After completing my Bachelor's Degree, I secured an internship in 2016 at the Jozef Stefan Institute, working under Prof. dr. Janez Bonča on many-body localization, co-authoring my first publication. In 2017, I moved to Leiden, Netherlands, to pursue a Master's Degree in Theoretical Physics, graduating with summa cum laude honors for my research on the transport properties of a Weyl superconductor in a vortex lattice, under the guidance of Prof. dr. Carlo Beenakker. In 2019, I began my PhD studies at the Lorentz Institute, continuing my work in Beenakker's theoretical nanophysics group. I focused on the study of topological systems in the presence of a magnetic field, with a particular emphasis on studying Weyl, Dirac, and Majorana fermions. Throughout my PhD, I participated in various conferences and summer schools, expanding my knowledge and presenting my research. I also worked as a teaching assistant for courses in computational physics, quantum theory, and quantum information, earning the Teaching Assistant Prize in 2023 for my contributions to the latter course.

Going forward, I will join the Free University of Berlin, as a postdoctoral researcher in the group of Prof. dr. Piet Brouwer. There I will delve deeper into the study of topological systems and other novel phenomena emerging in the field of condensed matter physics.

List of publications

[1] G. Lemut, M. J. Pacholski, S. Plugge, C. W. J. Beenakker and İ. Adagideli, *Magnus effect on a Majorana zero-mode*, arXiv:2303.05959, (2023) [Chapter 7].

[2] C. W. J. Beenakker, A. Donís Vela, G. Lemut, M. J. Pacholski and J. Tworzydło, *Tangent fermions: Dirac or Majorana fermions on a lattice without fermion doubling*, arXiv:2302.12793, (2023).

[3] A. Donís Vela, G. Lemut, J. Tworzydło and C. W. J. Beenakker, *Method to preserve the chiral-symmetry protection of the zeroth Landau level on a two-dimensional lattice*, Annals of Physics, 169208, (2023).

[4] A. Donís Vela, G. Lemut, M. J. Pacholski, J. Tworzydło and C. W. J. Beenakker, *Reflectionless Klein tunneling of Dirac fermions: comparison of split-operator and staggered-lattice discretization of the Dirac equation*, J. Phys. Cond. Matt. **34**, 364003 (2022).

[5] A. Donís Vela, M. J. Pacholski, G. Lemut, J. Tworzydło and C. W. J. Beenakker, *Massless Dirac fermions on a space-time lattice with a topologically protected Dirac cone*, Annalen der Physik **534**, 2200206, (2022).

[6] G. Lemut, M. J. Pacholski, J. Tworzydło and C. W. J. Beenakker, *Supercell symmetry modified spectral statistics of Kramers-Weyl fermions*, J. Phys. A: Math. Theor. **55**, 234003 (2022) [Chapter 4].

[7] M. J. Pacholski, G. Lemut, J. Tworzydło and C. W. J. Beenakker, *Generalized eigenproblem without fermion doubling for Dirac fermions on a lattice*, SciPost Physics **11**, 105 (2021).

[8] A. Donís Vela, G. Lemut, M. J. Pacholski and C. W. J. Beenakker, *Chirality inversion of Majorana edge modes in a Fu-Kane heterostructure*, New J. Phys. **23**, 103006 (2021).

[9] G. Lemut, M. J. Pacholski and C. W. J. Beenakker, *Chiral charge transfer along magnetic field lines in a Weyl superconductor*, Phys. Rev. B **104**, 125444 (2021) [Chapter 5].

[10] M. J. Pacholski, G. Lemut, O. Ovdat, İ. Adagideli and C. W. J. Beenakker, *Deconfinement of Majorana vortex modes produces a superconducting Landau level*, Phys. Rev. Lett. **126**, 226801 (2021) [Chapter 6].

[11] G. Lemut, A. Donís Vela, M. J. Pacholski, J. Tworzydło and C. W. J. Beenakker, *Magnetic breakdown spectrum of a Kramers-Weyl semimetal*, New J. Phys. **22**, 093022 (2020) [Chapter 3].

[12] G. Lemut, M. J. Pacholski, O. Ovdat, A. Grabsch, J. Tworzydło and C. W. J. Beenakker, *Localization landscape for Dirac fermions*, Phys. Rev. B **101**, 081405(R) (2020) [Chapter 2].

[13] G. Lemut, M. J. Pacholski, İ. Adagideli and C. W. J. Beenakker, *Effect of charge renormalization on electric and thermo-electric transport along the vortex lattice of a Weyl superconductor*, Phys. Rev. B **100**, 035417 (2019).

[14] G. Lemut, M. Mierzejewski and J. Bonča, *Complete Many-Body Localization in the t-J Model Caused by a Random Magnetic Field*, Phys. Rev. Lett. **119**, 246601 (2017).