Dislocations in stripes and lattice Dirac fermions

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Publications

1. S. I. Mukhin, A. Mesaros, J. Zaanen and F. V. Kusmartsev,
   Enhanced electronic polarizability of metallic stripes and the universality of the bond-stretching phonon anomaly in high-temperature cuprate superconductors,
   Phys. Rev. B **76**, 174521 (2007) [Chapter 6].

2. A. Mesaros, D. Sadri and J. Zaanen,
   The Berry phase of dislocations in graphene and valley conserving decoherence,
   Phys. Rev. B **79**, 155111 (2009) [Chapter 3].

3. A. Mesaros, D. Sadri and J. Zaanen,
   Parallel Transport in Graphene Parallels Gravity,
   Phys. Rev. B **82**, 073405 (2010) [Chapter 2]

4. A. Mesaros, S. Papanikolaou, C. F. J. Flipse, D. Sadri and J. Zaanen,
   Electronic States of Graphene Grain Boundaries,
   arXiv:1007.1137, submitted to Phys. Rev. B [Chapter 4].

5. A. Mesaros, S. Papanikolaou and J. Zaanen,
   Straining the Identity of Majorana Fermions,
   arXiv:1007.2350, submitted to Phys. Rev. Lett. [Chapter 5].

6. A. Mesaros, K. Fujita, I. Firmo, H. Eisaki, S. Uchida, S. Sachdev, J. Zaanen, J. C. Davis, M.J. Lawler, and E.-A. Kim,
   Behavior of Smectic Topological Defects in Cuprate Superconductors,
   to be submitted to *Science* [Chapter 7].

Curriculum Vitae

I was born in Senta, Serbia (SFR Yugoslavia at the time), on the 16^{th} of February 1982. After finishing primary school and *Gymnasium* there, I started my undergraduate studies at the Faculty of Physics, University of Belgrade, in 2001. I chose the theory track, and the diploma work with which I graduated in summer of 2006, "Full Symmetry Implementation in Multi-Orbit Single-Particle Models" was supervised by Prof. Milan Damnjanović. During undergraduate studies, I attended an astrophysics summer school in Odessa, and a European quantum mechanics school in Strasbourg. In the last year of studies I received two awards intended for a selection of best students, one covering the students of my Faculty, and the other all of Serbia. Starting from second year of high-school, I enjoyed being part of the astronomy program of the Petnica Science Center, a science camp for talented elementary- and high-school students. There I completed research projects, and after starting undergraduate studies, continued attending as a junior assistant involved in giving lectures and supervising projects.

In autumn of 2006., I began my Ph.D. studies under the supervision of Prof. Jan Zaanen at the Instituut-Lorentz for theoretical physics in Leiden. This thesis contains the main results of the research during this period. In the last year of my studies, I spent three months working at Cornell University. As a graduate student, I presented my work through talks and posters at several conferences in the Netherlands and the United States. During three years of my studies, I was teaching exercise classes at Leiden University, within condensed matter and advanced quantum mechanics courses for master students.

Acknowledgements

The time of my PhD at the Lorentz Institute in Leiden was a truly great experience, and I am very proud to have been at this special place. The atmosphere at the Institute has been constantly communicative, involved and cheerful, thanks to the examples set by the faculty and the staff. I enjoyed helpful conversations with Carlo Beenakker, David Santiago and Ana Achúcarro. Wim van Saarloos and Ana have, through their strong support, set great examples to follow. I also hope many students will have the opportunity to enjoy the enthusiasm of Fran and Marianne, who were always wonderful to me!

A positive side of my research were the interactions with students from other groups, which also lead to some great friendships. This communication was invaluable to me. For the scientific exchange, I explicitly thank Frank Krüger, Mihailo Čubrović, Jens Bardarson, Aron Beekman, Patrik Recher, Vladimir Juričić, Izak Snyman, Anton Akhmerov and Vladimir Cvetković.

I am grateful to have spent many hours talking to Darius Sadri. He really added a lot of context and fun to the several projects we worked on together. For my very first project I had a great experience in collaborating with Sergei Mukhin, and I look forward to our future joint work. During the last years, I enjoyed the communication with Kees Flipse, which has been really helpful and fruitful. At least one of my projects owes to the enthusiasm of Stefanos Papanikolaou. Finally, special thanks go to Luuk Ament, for being such a great officemate. Our conversations made days in the office so much more fulfilled.

While visiting Cornell for several months, I had the incredible privilege and joy of being hosted by Eun-Ah Kim. I learned a lot about research from her and Michael Lawler, and truly enjoyed every minute we worked together on a great topic. I especially thank Eun-Ah for her continuing immense care, support, and warm sincerity, which all mean a lot to me.

Here I want to express my deep gratefulness for the honest and passionate scientific and meta-scientific input I received from my mentor, as well as for his enthusiasm to interact.

The years of the PhD have been a trial too. I owe much to the support of my family, and dedicate this thesis to the people I missed being close to so much. Of course, not many things in my life, including the writing of this thesis, would make sense or would have been possible without Zorana.