Effects of spin-orbit coupling on quantum transport

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List of Publications

- *Coherent electronic transport in a multimode quantum channel with Gaussian-type scatterers*, J. H. Bardarson, I. Magnusdottir, G. Gudmundsdottir, C.-S. Tang, A. Manolescu, and V. Gudmundsson, Phys. Rev. B **70**, 245308 (2004).

- *Multi-mode transport through a quantum nanowire with two embedded dots*, V. Gudmundsson, G. Gudmundsdottir, J. H. Bardarson, I. Magnusdottir, C.-S. Tang, and A. Manolescu, Eur. Phys. J. B **45**, 339 (2005).

- *Transport through a quantum ring, a dot and a barrier embedded in a nanowire in magnetic field*, V. Gudmundsson, Y.-Y. Lin, C.-S. Tang, V. Moldoveanu, J. H. Bardarson, and A. Manolescu, Phys. Rev. B **71**, 235302 (2005).

- *Stroboscopic model of transport through a quantum dot with spin-orbit scattering*, J. H. Bardarson, J. Tworzydlo, and C. W. J. Beenakker, Phys. Rev. B **72**, 235305 (2005) [Chapter 2].

- *How spin-orbit interaction can cause electronic shot noise*, A. Ossipov, J. H. Bardarson, C. W. J. Beenakker, J. Tworzydlo, and M. Titov, Europhys. Lett. **76**, 115 (2006) [Chapter 3].

- *Degradation of electron-hole entanglement by spin-orbit coupling*, J. H. Bardarson and C. W. J. Beenakker, Phys. Rev. B **74**, 235307 (2006) [Chapter 4].

- *Effect of spin-orbit coupling on the excitation spectrum of Andreev billiards*, B. Béri, J. H. Bardarson, and C. W. J. Beenakker, Phys. Rev. B **75**, 165307 (2007).

- *Mesoscopic Spin Hall Effect*, J. H. Bardarson, I. Adagideli, and Ph. Jacquod, Phys. Rev. Lett. **98**, 196601 (2007) [Chapter 5].

- *Demonstration of one-parameter scaling at the Dirac point in graphene*, J. H. Bardarson, J. Tworzydlo, P. W. Brouwer, and C. W. J. Beenakker, Phys. Rev. Lett. **99**, 106801 (2007) [Chapter 6].

- *Splitting of Andreev levels in a Josephson junction by spin-orbit coupling*, B. Béri, J. H. Bardarson, and C. W. J. Beenakker, Phys. Rev. B **77**, 045311 (2008).

- *Non-local detection of resistance fluctuations of an open quantum dot*, A. I. Lerescu, E. J. Koop, C. H. van der Wal, B. J. van Wees, and J. H. Bardarson, submitted to Phys. Rev. B.

- *Theory of the valley-valve effect in graphene nanoribbons*, A. R. Akhmerov, J. H. Bardarson, A. Rycerz, and C. W. J. Beenakker, submitted to Phys. Rev. B.

- *A Proof of the Kramers Degeneracy of Transmission Eigenvalues From Antisymmetry of the Scattering Matrix*, J. H. Bardarson, to be submitted [Section 1.2.5].

Curriculum Vitæ

I was born in Reykjavík on the 20th of August 1979. I grew mostly up in Selfoss were I attended both grade school and high school at Fjölbrautaskóli Suðurlands, from where I graduated in 1999. The same year I started my undergraduate studies in physics at the University of Iceland. I spent one summer in Lille, France doing experimental work at the University of Science and Technology as a part of my bachelor degree, which I obtained in the summer of 2002. Shortly thereafter I started working under the supervision of Prof. Vidar Gudmundsson on my M.Sc. thesis titled *Grid-free ground state of molecules and transport in nanosystems*. My masters education included a one semester stay in Copenhagen, where I attended courses at both the University of Copenhagen and at the Technical University of Denmark. In September 2004 I began to work at the Institute Lorentz for theoretical physics at the University of Leiden, under the supervision of Prof. Carlo Beenakker. The fruits of that work are partially found in this thesis.

During both my undergraduate and graduate studies I have taught exercise classes in math and physics. I taught math to biology students, and linear algebra, calculus, and classical physics to engineering students. In Leiden I have taught the exercise class in Electromagnetism II three times. In addition to this teaching I have been involved in cluster management, both at the University of Iceland and in Leiden. I have attended a number of summer schools and represented my work in several conferences, both in Europe and in the United States.

Acknowledgments

Blindur er bóklaus maður[1]

As far as I can remember I have been surrounded by books and I cannot imagine life without them. But to really enjoy them discussing, dissecting, even sometimes debating their contents with other people is invaluable. Some people make this role their profession; we often call them teachers. All from reading my first few words as a young boy to writing this thesis I've had the good luck of being mentored through every stage of my edification by enthusiastic, honest and committed people. I can mention a few (Edda Björg Jónsdóttir, Halldór Páll Halldórsson, Reynir Hugason, Ari Ólafsson, Viðar Guðmundsson and Carlo Beenakker) but there are many more and I am equally grateful to all of them. Reflecting on about two decades of education I can not but feel privileged. The opportunity to obtain a balanced and unbiased education from young age is too easily taken for granted.

Ber er hver að baki, nema sér bróður eigi[2]

In this world, there is nothing more valuable than your family and friends. I couldn't have asked for a better family and I don't know how to put in words how much I love them. I hope they know. My friends are scattered around the world so most of them I see only very infrequently. It only takes a few moments to appreciate a real friendship though, and I value all the time I get immensely.

[1] Icelandic proverb, literally: Blind is a man without books.

[2] Icelandic proverb (from Njáls saga), literally: One's back is vulnerable, unless one has a brother.

Finally, the Institute Lorentz has treated me very kindly the time I've spent there. Even before day one, Marianne and Fran helped me with all kinds of things they didn't have to help me with, and always with a smile. For that I'm thankful. An institute is no more and no less then the people that inhabit it. At the Institute Lorentz everyone joins in to create a constructive and friendly atmosphere. An atmosphere that welcomes and stimulates, the ideal conditions for doing science. Knowing that it is not always like that, I thank each and everyone involved for their contribution. I guess I owe you all a hug.