

Curriculum vitae et studiorum Stephanie Matern

studi compiuti, i titoli conseguiti, le pubblicazioni e/o i rapporti tecnici e/o i brevetti, i servizi prestati, le funzioni svolte, gli incarichi ricoperti ed ogni altra attività scientifica, professionale e didattica eventualmente esercitata **(in ordine cronologico iniziando dal titolo più recente)**

Education & Academic career

- Postdoc at Lund University, Sweden;
Nov 2020 – Oct 2023, research focus: Dynamics and transport properties of non-equilibrium quantum systems;
Advisor: Prof. Martin Leijnse
- PhD in theoretical physics “Dynamical backaction effects between localised spins and electronic conductor”
Sept 2016 – Oct 2020, University of St Andrews, United Kingdom; Advisor: Dr. Bernd Braunecker
- Research assistant at Universität zu Köln, Germany
June- Aug 2016; Advisor: Maria Hermanns
- M.Sc. in physics, Universität zu Köln, Germany
Oct 2013-Dec 2015; Master thesis: “Unconventional magnetism in spin-orbit entangled Mott insulators”, Advisors:
Dr. Maria Hermanns and Prof. Simon Trebst
- B.Sc in physics, Universität zu Köln, Germany
Oct 2010 – Oct 2013, Bachelor thesis [in German]: “Hall conductivity Hofstadter’s butterfly”, Advisor: Dr. Lars Fritz
- Research Internship at University of Western Australia, Perth, Australia
Nov – Dec 2009, project at Australian International Gravitational Research center during year abroad
- Abitur [German high school diploma], Freiherr-vom-Stein-Schule, Rösrath, Germany

Manuscripts

- March 2023, **S. Matern**, K. Macieszczak, S. Wozny, M. Leijnse; *Metastability and quantum coherence assisted sensing in interacting parallel quantum dots*,
Phys. Rev. B **107**, 125424 (2023), arXiv identifier: 2212.07799
- Oct 2019, **S. Matern**, D. Loss, J. Klinovaja, B. Braunecker, *Coherent backaction between spins and an electronic bath: Non-Markovian dynamics and low-temperature quantum thermodynamic electron cooling*,
Phys. Rev. B **100**, 134208 (2019), arXiv identifier: 1905.11422
- June 2018, **S. Matern** and M. Hermanns, *Entanglement in 3D Kitaev Spin Liquids*,
J. Stat. Mech. 063101 (2018), arXiv identifier: 1712.07715
- July 2015, A. Cook, **S. Matern**, C. Hickey, A. Aczel, A. Paramekanti, *Spin-orbit coupled jeff = 1/2 iridium moments on the geometrically frustrated fcc lattice*
Phys. Rev. B **92**, 020417(R) (2015), arXiv identifier: 1502.01031

Luogo e data
Södra Sandby, 14/12/2023

FIRMA _____

Manuscripts (continued)

- Sept 2023, M. Nitsch, R. Seoane Souto, **S. Matern**, M. Leijnse, *Transport-based fusion that distinguishes between Majorana and Andreev bound states*, under review at Phys. Rev. B, arXiv identifier:2309.11328
- Dec 2023/Jan 2024, **S. Matern**, S.V. Moreira, P. Samuelsson, M. Leijnse, *Thermoelectric cooling in a non-equilibrium QD system coupled to a finite-size reservoir*, to be submitted

Relevant research experience for position

- **Dynamics of open quantum systems** – The focus of my research during my PhD was on investigating the full dynamics of open quantum systems, specifically *non-Markovian effects* in the relaxation dynamics of spins coupled to an electronic environment. In the process, I learned how to employ *quantum master equation approaches* to describe the dynamics of a quantum system; this expertise has been further refined in the last couple of years. The work of my PhD was mainly analytical, and resulted in closed form expressions for the correction beyond the Markovian approximation for the relaxation dynamics of a spin system [PRB 100, 13408 (2019)]. I am still involved in a follow-up, mainly analytical project, which looks into the effects of a strongly-correlated reservoir. The results are likely going to be published early next year.
- **Non-equilibrium transport of quantum devices** – During my postdoc at Lund University, I have been working on quantum transport of non-equilibrium systems with a strong focus on the *full dynamics beyond the stationary state properties*. Our recent publication [PRB 107, 125424 (2023)] is the result of a two-year project in the area of quantum sensing and lead to two main conclusions. Firstly, studying the transient dynamics in the Markovian limit in a combination of analytical and numerical work, we show that the investigated system, an interacting quantum system consisting of two parallel quantum dots, exhibits metastability. Before the true stationary state is reached, the system undergoes very slow dynamics with a unique signature in the time evolution. The slow dynamics stem from a broken, parity-like symmetry, and the timescale is set by small perturbations breaking that symmetry. Secondly, we show that the system can be used as a *charge sensing device utilizing quantum coherence effects*. It outperforms state-of-the-art single quantum dot charge sensors as it is not limited by temperature. Beyond this I was involved in a project on *distinguishing topologically trivial from topological bound states* using transport measurements [arXiv: 2309.11328]. Most recently, I have been investigating the effects of assuming finite-size reservoirs in non-equilibrium systems opposed to the assumption of infinite baths. Such considerations allow for tracking some system-bath correlations which are crucial for the understanding, modeling, and characterization of any open quantum system [Manuscript in preparation]. We show that the *finite-size character of the baths leads to a modified stationary states* compared to the standard approach of infinite reservoirs. Furthermore, we find a regime where heat is carried out of the finite-size reservoir establishing a *temperature lower than the temperature of the infinite reservoirs*.

Teaching & Outreach

- Sept/Oct 2022, lecture – Organiser and Teacher for short lecture course for PhD students, topic: “Introduction to dynamics in open quantum systems”
- June – Aug 2022, supervision of Bachelor student, project topic: “Dynamics at an exceptional point in an interacting quantum dot system”
- May – July 2019, Co-supervision of undergraduate summer students, project topic: “Entanglement spectrum of non-Hermitian systems”
- Oct 2012 – June 2020, Teaching assistant for various undergraduate courses including: Introduction to Condensed Matter Physics, Lagrangian & Hamiltonian Dynamics, Quantum Mechanics, broader 1st and 2nd year courses, lab demonstration
- Oct 2021/Feb 2022/Feb 2023/Oct 2023, workshop – Organiser/Presenter of workshop “Research - (sometimes) a bumpy road”; objective: raising awareness around mental health, aimed at junior researchers
- April – Oct 2023, talk series – Organiser of talk series “Qtalks” aimed at undergraduate students at Lund University objective: presenting ongoing research in quantum physics accessible for students
- Since Sept 2016, outreach – Various public engagement activities including workshops “Girls in Science”, science fairs, Science Slam “Every electron counts - A theorist's account of counting electrons”

Additional Skills & Experiences

- Dec 2020 – Oct 2023, Board member of the initiative “Equality, Diversity and Inclusion” within the Wallenberg Center for Quantum Technologies; objective: promote equality and diversity and to tackle discrimination
- Since March 2020, referee for scientific journals (Phys. Rev.)
- June 2018 – June 2020, Organiser of weekly seminar within physics department; Organiser of weekly journal club for PhD students
- March – April 2016, Internship at d-fine, IT, risk management and financial consultancy

Programming Languages

- Python (very proficient, mainly used during my research)
- C/C++ (basic knowledge)
- Computer algebra: mathematica (basic knowledge)
- Some experience in large scale calculation and collaborative projects

Languages

- German (native)
- English (fluent)

Luogo e data
Södra Sandby, 14/12/2023

FIRMA _____

Selected Conferences, Talks & Schools

- Oct 2023, talk – “Thermoelectric cooling with finite-size reservoirs”, Annual Meeting of NanoLund, Lund, Sweden
- Oct 2023/Nov 2022, talk – “Interacting parallel QDs: Metastability and quantum sensing”, Seminar talk at: Pitaevskii Center for Bose-Einstein Condensation, Trento, Italy
Autonomous University of Madrid, Spain
- May 2022, talk – “Quantum sensing with parallel QDs”, Annual Meeting of Wallenberg Centre for Quantum Technologies, Gothenburg, Sweden
- Sept 2019, summer school – “Quantum Matter out of Equilibrium”, Granada, Spain
- Dec 2018, workshop – “Advances in open systems and fundamental tests of quantum mechanics”, WE-Heraeus-Seminar, Bad Honnef, Germany, poster prize for my contribution “Memory effects in a simple metal”
- Oct 2018, talk “Memory effects in a simple metal”, PhD seminar at Technical University Dresden, Germany
- July 2018, summer school – “Boulder School 2018: Quantum Information”, Boulder, United States
- April 2017, school – “The Capri Spring School on Transport through Nanostructures 2017”, Capri, Italy

References

- Prof. Martin Leijnse, Lund University, Sweden
martin.leijnse@ftf.lth.se
- Dr. Bernd Braunecker, University of St Andrews, United Kingdom
bhb@st-andrews.ac.uk
- Dr. Maria Hermanns, Nordita and Stockholm University, Sweden
maria.hermanns@fysik.su.se

Luogo e data
Södra Sandby, 14/12/2023

(*) ai sensi dell'art. 15, comma 1 della Legge 12/11/2011, n. 183 le certificazioni rilasciate dalla P.A. in ordine a stati, qualità personali e fatti sono valide e utilizzabili solo nei rapporti tra privati; nei rapporti con gli Organi della Pubblica Amministrazione e i gestori di pubblici servizi, i certificati sono sempre sostituiti dalle dichiarazioni sostitutive di certificazione o dall'atto di notorietà di cui agli artt. 46 e 47 del DPR 445/2000

N.B:

1) Datare e sottoscrivere tutte le pagine che compongono la dichiarazione.