

Nikolaus Hartman

EXPERIMENTAL CONDENSED MATTER PHYSICIST

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Summary

Experimental condensed matter physicist with extensive low-noise measurement, data analysis, and nano-fabrication experience looking to continue developing new techniques and materials toward scalable quantum computers. My interests range along the entire quantum computing stack including single qubit design/testing, low temperature hardware, and control software.

Experience

Microsoft Station Q Purdue

West Lafayette, Indiana, USA

SENIOR RESEARCHER

April 2019 - PRESENT

- Work with an international team of researchers to characterize hybrid materials that will form the basis of topological qubits. Carrying out low-noise, low-temperature transport measurements focusing on semiconductor and superconductor material property measurements.
- Work iteratively with materials growth and device fabrication teams to screen and improve sample quality. Results extracted from transport measurements are regularly read-out to colleagues across a broad range of expertise.
- Develop measurement protocols and techniques to produce consistent measurements/analyses across materials, locations, and time. This work includes device design, hardware design/configuration, and software automation in python.
- Lead a small team of contract employees in the above workflow. Additionally, work as acting lab manager for both the Microsoft and academic team. Management roles include equipment purchase/maintenance, supervision of measurements conducted by academic team, and interfacing with both the Purdue physics department and Microsoft corporate team on behalf of the lab.

University of British Columbia

Vancouver, BC, Canada

POSTDOCTORAL FELLOW – QUANTUM TRANSPORT LAB

Oct. 2015 - PRESENT

- Designed and tested the first measurement of entropy at the single particle level. Follow up experiments to investigate single and multiple channel Kondo effect using this technique are on-going in the lab.
- Measured spin impurities in graphene through magnetotransport. Identified new Kondo-like physics in graphene below 50mK.
- Worked with Microsoft and University of Copenhagen to test InAs VLS nanowire and 2DEG devices. Iterative design/testing process helped steer the collaboration toward stable 2DEG device geometries. Additional collaboration with UBC chemistry investigated alternate routes to clean Al etching.
- Collaborated on design and testing of custom dilution refrigerator electronics, with a focus on efficient electron cooling. Designed and fabricated a number of unique broadband filters, resulting in a cryogen-free dilution refrigerator with <25mK electron temperatures.

Johns Hopkins University

Baltimore, MD, USA

DOCTORAL STUDENT

Aug. 2008 - Aug. 2015

- Fabricated single-wall carbon nanotube quantum dots using chemical vapor deposition growth along with various microscopy and lithographic techniques. Improved electron lithography resolution to 25nm by adopting cutting edge processing techniques. Built novel image processing tool to improve device design accuracy and throughput (gh-link).
- Measured devices in a variety of custom-wired cryostat systems from 4K down to 50mK. Nanotube devices were measured using hand-built amplifiers with LabVIEW and Python control software.
- Investigated a variety of spin-dependent phenomena in low-noise, low-temperature transport measurements. Identified signatures of spin selection rules in ferromagnetically contacted CNT quantum dots.
- Characterized electrical conductivity in peptide fibers using atomic and electric force microscopy as part of nano-biotech collaboration with JHU chemistry and materials science.

Education

Johns Hopkins University

Baltimore, MD, USA

PH.D., EXPERIMENTAL CONDENSED MATTER PHYSICS

Aug. 2008 - Aug. 2015

- Thesis: *Fabrication and Transport Properties of Carbon Nanotube Quantum Dots with Ferromagnetic and Superconducting Leads*

University of Pittsburgh

Pittsburgh, PA, USA

B.S., PHYSICS

Aug 2003 - Apr 2007

- Minors in Music and Mathematics

Skills

Experimental

Low-Noise Analog and Digital Electronics, Cryogenics (dilution refrigerator and He3 cryostats), Electron Beam and UV Lithography, Chemical Vapor Deposition, Thin Film Deposition, Atomic and Electric Force Microscopy

Analysis

Python, UNIX, git, LaTeX, Design of Experiment

Teaching

- Extensive experience as a teaching assistant including Electricity and Magnetism, Classical Mechanics, Modern Physics, Statistical Mechanics, and Quantum Mechanics.
- Two years as head teaching assistant, leading group of 5-10 TAs, in General Physics I+II.
- Awarded Rowland Prize for Innovation and Excellence in Teaching at JHU in 2011
- Supervised many undergraduate interns as a post-doc at UBC and graduate student at JHU. Projects ranged from a successful home-built ALD reactor to customized RPi-based measurement electronics.

Publications and Talks

Author

Kondo-like Behavior in Monolayer CVD Graphene at Low Temperatures

Silvia Lüscher, Nikolaus Hartman, Hyungki Shin, Ebrahim Sajadi, Ali Khademi, Joshua Folk
([IN PREP](#)).

Direct entropy measurement in a mesoscopic quantum system

Nikolaus Hartman, Christian Olsen, Silvia Lüscher, Mohammad Samani, Saeed Fallahi, Geoffrey C Gardner, Michael Manfra, Joshua Folk
[Nature Physics](#) (2018).

Measurement of critical currents of superconducting aluminum nanowires in external magnetic fields: Evidence for a Weber blockade

T. Morgan-Wall, B. Leith, N. Hartman, A. Rahman, N. Marković
[Physical Review Letters](#) 114, 077002 (2015).

Fabrication of sub-15 nm aluminum wires by controlled etching

T. Morgan-Wall, H. J. Hughes, N. Hartman, T. M. McQueen, N. Marković
[Applied Physics Letters](#) 104, 173101 (2014).

Synthesis and alignment of discrete polydiacetylene-peptide nanostructures

S. R. Diegelmann, N. Hartman, N. Marković, J. D. Tovar
[Journal of the American Chemical Society](#) 134, 2028–2031 (2012).

Speaker

Quantum Computing: From Transistors to Quantum Supremacy

N. Hartman
[Nerd Nite YVR—Vancouver, BC, Canada](#) (June 2018).

Direct Entropy Measurement in a Mesoscopic Quantum System

N. Hartman, C. Olsen, S. Luescher, M. Samani, S. Fallahi, G. Gardner, M. Manfra, J. Folk
[Condensed Matter Seminar—Stanford University, CA, USA](#) (March 2018).

Suppressed Conductance From Spin-Selection Rules in F-CNT-F Quantum Dots

N. Hartman, T. Morgan-Wall, N. Marković
[APS March Meeting—Baltimore, MD, USA](#) (March 2016).

Charge and Spin Transport in Carbon Nanotube Quantum Dots

N. Hartman, N. Marković
[Condensed Matter Seminar—University of California Santa Barbara, CA, USA](#) (June 2015).