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Decreto Rettore Università di Roma “La Sapienza” n 2267/2021 del 09.08.2021

BERNARD VAN HECK
Curriculum Vitae

Roma
27.09.2021

Part I – General Information

Full Name	Bernard van Heck
Spoken Languages	Italian, English

Part II – Education

Type	Year	Institution	Notes
B.Sc, Physics	2008	Sapienza Università di Roma	Laurea Triennale, Advisor: Prof. Massimo Testa, 110 e lode
M.Sc, Physics	2011	Sapienza Università di Roma	Laurea Magistrale, Advisor: Prof. Antonio Polosa, 110 e lode
PhD, Physics	2015	Universiteit Leiden	Dottorato, Advisor: Prof. Carlo Beenakker

Part III – Appointments

Start	End	Institution	Position
01-10-2015	31-05-2017	Yale University, U.S.A.	Postdoctoral researcher Advisor: Leonid Glazman
01-06-2017	31-12-2018	Microsoft Quantum, Station Q, UCSB, Santa Barbara, U.S.A.	Researcher
01-01-2019	31-08-2021	Microsoft Quantum, TU Delft, The Netherlands	Senior Researcher

Part IV – Teaching experience

Year	Institution	Lecture/Course
2013, 2014	Universiteit Leiden	Teaching Assistant Quantum Mechanics

2015	TU Delft	Course staff for the **Massive Online Open Course** (MOOC) on "Topology in Condensed Matter", originally hosted by edX, now on https://topocondmat.org/
2015	TU Delft	Lecture series on quantum computation with Majorana zero modes, for graduate students and postdocs.

Part V - Society memberberships, Awards and Honors

Year	Title
2018	**Outstanding Referee** of the **American Physical Society**
2016	Winner of a **Marie Skłodowska-Curie Global Fellowship** from the European Commission, with score 94.80/100 (grant declined).
2016	Winner of the **Christyian Huygens Prize** for my PhD thesis. The prize (10.000 euros) is awarded to the best Dutch PhD thesis in physics in a five-year period.
2015	Selected participant by the **Royal Netherlands Academy of Arts and Sciences** to participate in the **65th Lindau Nobel Laureate Meeting**, Lindau, Germany, 28 June-3 July 2015.

Part VI – Research Activities

PhD research (2011-2015). After graduating in physics at Sapienza, I moved to the Netherlands for my PhD studies under the supervision of Carlo Beenakker at Leiden University. My PhD research was focused on the development of a theory of superconducting circuits in the presence of Majorana zero modes. This focus was complemented by separate works on disordered systems, non-Abelian anyons, and Josephson junctions. Most of my studies were done in the context of the rapidly expanding fields of topological quantum computations and topological aspects of condensed matter physics in general. My PhD Thesis won the Christiaan Huygens prize in 2016 and generated considerable experimental interest.

Postdoctoral research (2015-2017). During my postdoc at Yale University under the supervision of Leonid Glazman, I have focused on the theoretical interpretation of experimental data on proximitized nanowire devices. In 2015 and 2016 I collaborated with the groups Leo DiCarlo and Leo Kouwenhoven at TU Delft, the Netherlands on two different projects which realized the first prototypes of superconducting circuits involving nanowires and measured the excitation spectrum of a nanowire Josephson junction. I also investigated the transport signatures of the Majorana topological transition in the Coulomb blockade regime, providing a quantitative analysis of some crucial experiments in this field.

Research at Microsoft Quantum (2017-2021). My work continued organically during my tenure with Microsoft Quantum, which started at Station Q in Santa Barbara, U.S.A. and continued in Delft, the Netherlands, after an extended visit at the Center for Quantum Devices in Copenhagen. During this time, I have been heavily involved in the effort to systematize the search for Majoranas by promoting a data-driven approach to transport measurements, and I have been driving research on cQED devices with semiconductor-based Josephson junctions. As part of my research duties, I have been collaborating with the experimental part of Microsoft's quantum computing program daily, contributing to both the conceptual design of experiments and the interpretation of the data as well as, on some occasions, the experimental measurements themselves. In 2020-2021, I supervised

a team of two simulation engineers for in-house realistic simulations of hybrid devices, as well as three PhD students performing experiments on hybrid superconducting qubits.

Part VII – Summary of Scientific Achievements

Scientific Publications.

I have co-authored 31 publications, published in the following journals: Science (1), Nature Physics (1), Physical Review Letters (8), Physical Review B (15), Physical Review A (1), SciPost Physics (1), Nature Communications (1), New Journal of Physics (1), Physica Scripta (1).

All my publications all openly available on arXiv, at this link: http://arxiv.org/a/vanheck_b_1, and are listed here in reverse chronological order:

1. *Full parity phase diagram of a proximitized nanowire island*, J. Shen, G.W. Winkler, F. Borsoi, S. Heedt, V. Levajac, J.Y. Wang, D. van Driel, D. Bouman, S. Gazibegovic, R.L.M. Op Het Veld, D. Car, J.A. Logan, M. Pendharkar, C.J. Palmstrom, E.P.A.M. Bakkers, L.P. Kouwenhoven, and **B. van Heck**, Phys. Rev. B 104, 045422 (2021).
2. *Quantum-critical dynamics of a Josephson junction at the topological transition*, V.D. Kurilovich, C.M. Murthy, P.D. Kurilovich, **B. van Heck**, L.I. Glazman, and C. Nayak, Phys. Rev. B 104, 014509 (2021), **Editors' Suggestion.**
3. *Protocol to identify a topological superconducting phase in a three-terminal device*, D.I. Pikulin, **B. van Heck**, T. Karzig, E.A. Martinez, B. Nijholt, T. Laeven, G.W. Winkler, J.D. Watson, S. Heedt, M. Temurhan, V. Svidenko, R.M. Lutchyn, M. Thomas, G. de Lange, L. Casparis, C. Nayak, arXiv:2103.12217 (2021), to be submitted.
4. *Josephson current via an isolated Majorana zero mode*, C.-X. Liu, **B. van Heck**, and M. Wimmer, Phys. Rev. B 103, 014510 (2021).
5. *Andreev Modes from Phase Winding in a Full-shell Nanowire-based Transmon*, A. Kringhøj, G. W. Winkler, T. W. Larsen, D. Sabonis, O. Erlandsson, P. Krogstrup, **B. van Heck**, K. D. Petersson, and C. M. Marcus, Phys. Rev. Lett. 126, 047701 (2021).
6. *Destructive Little-Parks Effect in a Full-Shell Nanowire-based Transmon*, D. Sabonis, O. Erlandsson, A. Kringhøj, **B. van Heck**, T.W. Larsen, I. Petkovic, P. Krogstrup, K.D. Petersson, and C.M. Marcus, Phys. Rev. Lett. 125, 156804 (2020).
7. *Suppressed charge dispersion via resonant tunneling in a single-channel transmon*, A. Kringhøj, **B. van Heck**, T.W. Larsen, O. Erlandsson, D. Sabonis, P. Krogstrup, L. Casparis, K.D. Petersson, and C.M. Marcus, Phys. Rev. Lett. 124, 246803 (2020).
8. *Observation of vanishing charge dispersion of a nearly-open superconducting island*, A. Bargerbos, W. Uilhoorn, C.-K. Yang, P. Krogstrup, L.P. Kouwenhoven, G. de Lange, **B. van Heck**, and A. Kou, Phys. Rev. Lett. 124, 246802 (2020).
9. *Energy spectrum and current-phase relation of a nanowire Josephson junction close to the topological transition*, C.M. Murthy, V.D. Kurilovich, P.D. Kurilovich, B. van Heck, L.I. Glazman and C. Nayak, Phys. Rev. B 101, 224501 (2020).
10. *Flux-induced topological superconductivity in full-shell nanowires*, S. Vaitiekenas, G.W. Winkler, **B. van Heck**, T. Karzig, M.-T. Deng, K. Flensberg, L.I. Glazman, C. Nayak, P. Krogstrup, R.M. Lutchyn, and C.M. Marcus, Science, 367, eeav3392 (2020).
11. *Controlled DC monitoring of a superconducting qubit*, A. Kringhøj, T.W. Larsen, **B. van Heck**, D. Sabonis, O. Erlandsson, I. Petkovic, D.I. Pikulin, P. Krogstrup, K.D. Petersson, and C.M. Marcus, Phys. Rev. Lett. 124, 056801 (2020).
12. *Spectral response of Josephson junctions with low-energy quasiparticles*, A. Keselman, C.M. Murthy, **B. van Heck** and B. Bauer, SciPost Phys. 7, 050 (2019).

13. *A unified numerical approach to semiconductor-superconductor heterostructures*, G.W. Winkler, A.E. Antipov, **B. van Heck**, A. Soluyanov, L.I. Glazman, M.W. Wimmer, and R.M. Lutchyn, Phys. Rev. B 99, 245408 (2019).
14. *Parity transitions in the superconducting ground state of hybrid InSb-Al Coulomb islands*, J. Shen, S. Heedt, F. Borsoi, **B. van Heck**, S. Gazibegovic, R. L. M. Op het Veld, D. Car, J. A. Logan, M. Pendharkar, G. Wang, D. Xu, D.Bouman, A. Geresdi, C. J. Palmstrom, E. P. A. M. Bakkers and L. P. Kouwenhoven, Nature Communications 9, 4801 (2018).
15. *Quantum Criticality in Resonant Andreev Conduction*, M. Pustilnik, **B. van Heck**, R.M. Lutchyn and L.I. Glazman, Phys. Rev. Lett. 119, 116802 (2017).
16. *Zeeman and spin-orbit effects in the Andreev spectra of nanowire junctions*, **B. van Heck**, J.I. Väyrynen and L.I. Glazman, Phys. Rev. B 96, 075404 (2017), **Editors' Suggestion**.
17. *Microwave spectroscopy of spinful Andreev bound states in ballistic semiconductor Josephson junctions*, D.J. van Woerkom, A. Proutski, **B. van Heck**, D. Bouman, J.I. Väyrynen, L.I. Glazman, P. Krogstrup, J. Nygård, L.P. Kouwenhoven, and A. Geresdi, Nature Physics 13, 876-881 (2017).
18. *Conductance of a proximitized nanowire in the Coulomb blockade regime*, **B. van Heck**, R.M. Lutchyn, and L.I. Glazman, Phys. Rev. B 93, 235431 (2016), **Editors' Suggestion**.
19. *Topologically protected charge transfer along the edge of a chiral p-wave superconductor*, N.V. Gnezdilov, **B. van Heck**, M. Diez, J.A. Hutasoit, and C.W.J. Beenakker, Phys. Rev. B 92, 121406(R) (2015), Rapid Communication.
20. *Realization of microwave quantum circuits using hybrid superconducting-semiconducting nanowire Josephson elements*, G. de Lange, **B. van Heck**, A. Bruno, D.J. van Woerkom, A. Geresdi, S.R. Plissard, E.P.A.M. Bakkers, A.R. Akhmerov and L. DiCarlo, Phys. Rev. Lett. 115, 127002 (2015), **Editors' Suggestion** and **Viewpoint in Physics**.
21. *Minimal circuit for a flux-controlled Majorana qubit in a quantum spin-Hall insulator*, **B. van Heck**, T. Hyart and C.W.J. Beenakker, Phys. Scr. 014007 (2015). Contribution for the proceedings of the Nobel Symposium on topological insulators.
22. *Single fermion manipulation via superconducting phase differences in multiterminal Josephson junctions*, **B. van Heck**, S. Mi and A.R. Akhmerov, Phys. Rev. B 90, 155450 (2014), **Editors' Suggestion**.
23. *Thermal conductance as a probe of the non-local order parameter for a topological superconductor with gauge fluctuations*, **B. van Heck**, E. Cobanera, J. Ulrich and F. Hassler, Phys. Rev. B 89, 165416 (2014).
24. *Statistical Topological Insulators*, I.C. Fulga, **B. van Heck**, J.M. Edge and A.R. Akhmerov, Phys. Rev. B 89, 155424 (2014), **Editors' Suggestion**.
25. *Effects of disorder on Coulomb-assisted braiding of Majorana zero modes*, I.C. Fulga, **B. van Heck**, M. Burrello, and T. Hyart, Phys. Rev. B 88, 155435 (2013).
26. *Flux-controlled quantum computation with Majorana fermions*, T. Hyart, **B. van Heck**, I.C. Fulga, M. Burrello, A.R. Akhmerov and C.W.J. Beenakker, Phys. Rev. B 88, 035121 (2013).
27. *Topological phases in two-dimensional arrays of parafermionic zero modes*, M. Burrello, **B. van Heck** and E. Cobanera, Phys. Rev. B 87, 195422 (2013).
28. *Braiding of non-Abelian anyons using pairwise interactions*, M. Burrello, **B. van Heck** and A.R. Akhmerov, Phys. Rev. A 87, 022343 (2013).
29. *Topological blockade and measurement of topological charge*, **B. van Heck**, M. Burrello, A. Yacoby and A.R. Akhmerov, Phys. Rev. Lett. 110, 086803 (2013).
30. *Coulomb-assisted braiding of Majorana fermions in a Josephson junction array*, **B. van Heck**, A.R. Akhmerov, F. Hassler, M. Burrello and C.W.J. Beenakker, New J. Phys. 14, 035019 (2012).
31. *Coulomb stability of the 4π-periodic Josephson effect of Majorana fermions*, **B. van Heck**, F. Hassler, A.R. Akhmerov, and C.W.J. Beenakker, Phys. Rev. B 84, 180502(R) (2011), Rapid Communication.

Scientific metrics.

The metrics below have been retrieved from Scopus and Google Scholar on September 25, 2021.

	SCOPUS	**Google Scholar**
Number of Publications	31	31
Total Citations	1016	1535
Average Citations	32.8	49.5
Hirsch (H) index	14	16

Presentations and seminars. This is a selection of invited presentations and seminars.

1. *Transmon-based spectroscopy of an Andreev quantum dot,* IOP CMD online series "Bound states in hybrid semiconducting-superconducting devices", 28-29 June 2021.
2. *cQED with hybrid superconducting-semiconducting devices,* seminar, RWTH Aachen, Germany, 13 February 2020.
3. *cQED with Majorana devices,* workshop "Enabling Quantum Leap: Braiding and Fusing Majoranas", University of Maryland, College Park, USA, 10 July 2019.
4. *Topological quantum computing with Majoranas: the search for robust designs,* workshop "Majorana modes and beyond", MagTop IF PAN, Warsaw, Poland, 27 February 2019.
5. *Andreev levels in nanowire Josephson junctions: theory of microwave spectra, S*tation Q fall meeting, Santa Barbara, USA, 2 December 2016.
6. Invited participant, "Workshop on Majorana Modes in Nanowires: Past and Future, University of Maryland", College Park, USA, October 2016.
7. *Majoranas, superconducting circuits and the experimental design of a topological quantum computer,* "This week's discoveries" seminar, Leiden University, the Netherlands, 2 June 2015.
8. *Superconducting circuits with Majorana modes,* seminar, Yale University, USA, 1st December 2014.
9. *Breaking time-reversal symmetry and switching fermion parity with superconducting phase differences,* Kavli-MPQ workshop, Garching, Germany, 13 June 2014.
10. *Quantum computation with Majorana zero modes in superconducting circuits,* workshop "New frontiers for Majorana fermions, from condensed to dark matter", Frascati, Italy, May 2014.
11. *Superconducting circuits for the manipulation of Majorana fermions,* conference "Frontiers in Quantum Engineered Devices", Obergurgl, Austria, 21 August 2013.
12. *Quantum computation with Majorana fermions in topological superconductors,* seminar, Università di Roma "La Sapienza", Italy, 18 May 2012.
13. *Josephson junction arrays with Majorana fermions,* RWTH Aachen, Germany, 2 November 2011.

Part VIII – Selected Publications

List of the publications selected for the evaluation. For each publication report title, authors, reference data, journal IF (if applicable), citations, press/media release (if any).

These are the 12 publications selected for evaluation. Impact factors quoted are for the year of publication (or, for articles published in 2021, for the most recent value of 2020). Citation numbers are retrieved from Google Scholar on 25 September 2021.

1. *Full parity phase diagram of a proximitized nanowire island*, J. Shen, G.W. Winkler, F. Borsoi, S. Heedt, V. Levajac, J.Y. Wang, D. van Driel, D. Bouman, S. Gazibegovic, R.L.M. Op Het Veld, D. Car, J.A. Logan, M. Pendharkar, C.J. Palmstrom, E.P.A.M. Bakkers, L.P. Kouwenhoven, and **B. van Heck**, Phys. Rev. B 104, 045422 (2021).
    - Journal impact factor: 4.036.
    - 4 citations.

2. *Quantum-critical dynamics of a Josephson junction at the topological transition*, V.D. Kurilovich, C.M. Murthy, P.D. Kurilovich, **B. van Heck**, L.I. Glazman, and C. Nayak, Phys. Rev. B 104, 014509 (2021)
    - Journal impact factor: 4.036.
    - Editors' suggestions.
    - No citations yet.

3. *Destructive Little-Parks Effect in a Full-Shell Nanowire-based Transmon*, D. Sabonis, O. Erlandsson, A. Kringhøj, **B. van Heck**, T.W. Larsen, I. Petkovic, P. Krogstrup, K.D. Petersson, and C.M. Marcus, Phys. Rev. Lett. 125, 156804 (2020).
    - Journal impact factor: 9.161.
    - 10 citations.

4. *Observation of vanishing charge dispersion of a nearly-open superconducting island*, A. Bargerbos, W. Uilhoorn, C.-K. Yang, P. Krogstrup, L.P. Kouwenhoven, G. de Lange, **B. van Heck**, and A. Kou, Phys. Rev. Lett. 124, 246802 (2020).
    - Journal impact factor: 9.161.
    - 20 citations

5. *Spectral response of Josephson junctions with low-energy quasiparticles*, A. Keselman, C.M. Murthy, **B. van Heck** and B. Bauer, SciPost Phys. 7, 050 (2019).
    - Journal impact factor: 5.051.
    - 13 citations

6. *A unified numerical approach to semiconductor-superconductor heterostructures*, G.W. Winkler, A.E. Antipov, **B. van Heck**, A. Soluyanov, L.I. Glazman, M.W. Wimmer, and R.M. Lutchyn, Phys. Rev. B 99, 245408 (2019).
    - Journal impact factor: 3.575.
    - 46 citations

7. *Zeeman and spin-orbit effects in the Andreev spectra of nanowire junctions*, **B. van Heck**, J.I. Väyrynen and L.I. Glazman, Phys. Rev. B 96, 075404 (2017).
    - Journal impact factor: 3.813.
    - Editors' Suggestion
    - 21 citations

8. *Microwave spectroscopy of spinful Andreev bound states in ballistic semiconductor Josephson junctions*, D.J. van Woerkom, A. Proutski, **B. van Heck**, D. Bouman, J.I. Väyrynen, L.I. Glazman, P. Krogstrup, J. Nygård, L.P. Kouwenhoven, and A. Geresdi, Nature Physics 13, 876-881 (2017).
    - Journal impact factor: 22.727.
    - 85 citations

9. *Conductance of a proximitized nanowire in the Coulomb blockade regime*, **B. van Heck**, R.M. Lutchyn, and L.I. Glazman, Phys. Rev. B 93, 235431 (2016).
    - Journal impact factor: 3.836.
    - Editors' Suggestion
    - 89 citations

10. *Realization of microwave quantum circuits using hybrid superconducting-semiconducting nanowire Josephson elements*, G. de Lange, **B. van Heck**, A. Bruno, D.J. van Woerkom, A. Geresdi, S.R. Plissard, E.P.A.M. Bakkers, A.R. Akhmerov and L. DiCarlo, Phys. Rev. Lett. 115, 127002 (2015).
    - Journal impact factor: 7.645.
    - Editors' Suggestions.
    - Featured for a Viewpoint in Physics: https://physics.aps.org/articles/v8/87
    - 163 citations.

11. *Single fermion manipulation via superconducting phase differences in multiterminal Josephson junctions*, **B. van Heck**, S. Mi and A.R. Akhmerov, Phys. Rev. B 90, 155450 (2014)
    - Journal impact factor: 3.736.
    - Editors' Suggestions.
    - 61 citations.

12. *Statistical Topological Insulators*, I.C. Fulga, **B. van Heck**, J.M. Edge and A.R. Akhmerov, Phys. Rev. B 89, 155424 (2014).
    - Journal impact factor: 3.736.
    - Editors' Suggestions.
    - 88 citations

Firmato: Bernard van Heck, 27 Settembre 2021