

Humboldt University of BerlinHead of **Theoretical Transport Physics**, Institute of Physics [2024 -]

- ☀ *Emmy Noether Grant, DFG*
- Principal investigator

Postdoc, Institute of Physics & IRIS Adlershof [2022 - 2024]

- ☀ *Research Fellowship, Alexander von Humboldt Foundation*
- ☀ *German Language Fellowship, Alexander von Humboldt Foundation*
- ☀ *Research Fellowship, Max Planck Institute Stuttgart*
- Conducted research in the field of thermoelectric transport and superconductivity.
- Published 4 research papers.
- Gave 2 invited and 4 contributed talks.
- Co-supervised 2 Bachelor's theses.

Catalan Institute of Nanoscience and Nanotechnology

Postdoc, Theory and Simulation [2021 - 2022]

- Developed scientific software ([elphbolt](#)) for thermoelectricity simulations.
- Published 2 research papers.
- Gave 2 talks.

Harvard University

Postdoc, School of Engineering & Applied Sciences [2019 - 2021]

- Wrote software for thermoelectricity and superconductivity simulations.
- Published 3 research papers.
- Gave 1 talk.

Boston College

PhD student, Department of Physics [2014 - 2019]

- ☀ *Conference travel grants, Boston College*
- Developed an original theoretical and computational framework for thermoelectric transport simulations, solving a century-old problem.
- Wrote scientific software for simulating thermoelectric transport.
- Published 6 research papers.
- Wrote 1 PhD thesis.
- Gave 4 talks.
- Taught undergraduate level physics.

University of Ottawa

Master's student, Department of Physics [2011 - 2013]

- ☀ *Differential Admission Scholarship, University of Ottawa*
- Implemented a many-body quantum chemistry method for studying laser-matter interactions.
- Published 2 research papers.
- Wrote 1 MSc thesis.
- Taught undergraduate level physics.
- Gave 1 talk.

Brac University

Teaching assistant, Department of Physics [2010 - 2011]

- Taught undergraduate level physics and mathematics.

Bachelor's student, Department of Physics [2006 - 2010]

- ☀ *Highest Distinction & Vice Chancellor's Medal, Brac University*
- ☀ *6-month scholarship to Romania, Erasmus Mundus*
- Got training in physics (major) and computer science (minor).
- Wrote scientific software for simulating quantum field theories on non-commutative geometries.
- Wrote 1 BSc thesis.
- Gave 2 talks..

Contact

- ✉ nakib.haider.protik@gmail.com
- 🌐 [LinkedIn](#)
- 🌐 [Research group website](#)
- 🌐 [Github](#)
- 📄 [Google Scholar](#)

Education

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|------|-----------------------------|
| 2019 | PhD Physics, Boston College |
| 2013 | MSc Physics, U of Ottawa |
| 2010 | BSc Physics, Brac U |

Skills

| | |
|-------------------------------------|-----|
| ★ Physics | ●●● |
| ★ Research | ●●● |
| ★ Project management | ●●● |
| ★ Scientific communication | ●●● |
| ★ Peer reviewing | ●●● |
| ★ Funding acquisition | ●●○ |
| ★ Teaching | ●●● |
| ★ Mentoring | ●●○ |
| ★ Software development | ●●● |
| ★ Scientific computation | ●●● |
| ★ High-performance computing | ●●● |
| ★ Modern Fortran [coarrays and OO] | ●●● |
| ★ Python [numpy, matplotlib, scipy] | ●●○ |
| ★ Julia | ●○○ |
| ★ C | ●○○ |
| ★ Mathematica | ●○○ |
| ★ Shell | ●○○ |
| ★ Linux | ●●● |
| ★ Lisp | ●○○ |
| ★ \LaTeX | ●●● |
| ★ Bangla | ●●● |
| ★ English | ●●● |
| ★ German | ●○○ |

Attachments

- I Research
- II Teaching
- III Service

I Research

My research is on the physics of interactions and transport phenomena in condensed matter. Specifically, using *ab initio* theoretical and computational tools, I study how the scattering processes in matter – electron-phonon, phonon-phonon, phonon-defects, electron-defects, etc. – affect the transport properties. I am also generally interested in superconductivity, topological defects, and topological phases among various other topics.

Published code

2021



A solver for the coupled and decoupled electron and phonon Boltzmann transport equations.

Theses

2019

PhD Thesis, Physics, Boston College.

Topic: Theoretical/computational condensed matter physics with an emphasis on semiclassical transport.

Title: *Phonon and carrier transport in semiconductors from first principles.*

Committee: David Broido (chair), Kenneth Burch, Krzysztof Kempa, Fazel Tafti, and Natalio Mingo.

2013

MSc Thesis, Physics, University of Ottawa.

Topic: Attosecond phenomena in laser-matter interaction using computational many-body quantum methods.

Title: *The multiconfiguration time dependent Hartree-Fock method for cylindrical systems.*

Advisor: Thomas Brabec.

2010

BSc Thesis, Physics, BRAC University.

Topic: Numerical studies of quantum field theories on non-commutative geometries.

Title: *Chern-Simons action on the noncommutative plane.*

Advisor: Arshad Momen.

Publications (* = equal contribution)

2024

Nakib H. Protik and Claudia Draxl.

[Beyond the Tamura model of phonon-isotope scattering.](#)

Physical Review B.

2023

Mahmoud Elhajhasan, Wilken Seemann, Katharina Dudde, Daniel Vaske, Gordon Callsen, Ian Rousseau, Thomas F. K. Weatherley, Jean-François Carlin, Raphaël Butté, and Nicolas Grandjean, **Nakib H. Protik**, and Giuseppe Romano.

[Joined optical and thermal characterization of a III-nitride semiconductor membrane by micro-photoluminescence spectroscopy and Raman thermometry.](#)

Physical Review B.

2023

Krzysztof Kempa, **Nakib H. Protik**, Tyler Dodge, Claudia Draxl, and Michael J. Naughton.

[Enhancing superconductivity with resonant anti-shielding and topological plasmon-polarons.](#)

Physical Review B.

2023

Yu Xie, Jonathan Vandermause, Senja Ramakers, **Nakib H. Protik**, Anders Johansson, and Boris Kozinsky. [Uncertainty-aware molecular dynamics from Bayesian active learning for phase transformations and thermal transport in SiC.](#)

npj Computational Materials.

2023

Chunhua Li, **Nakib H. Protik**, Navaneetha K. Ravichandran, and David Broido.

[High-frequency phonons drive large phonon-drag thermopower in semiconductors at high carrier density.](#)

Physical Review B.

2022

Chunhua Li, **Nakib H. Protik**, Pablo Ordejón, and David Broido.

[Colossal phonon drag enhanced thermopower in lightly doped diamond.](#)

Materials Today Physics.

2022

Nakib H. Protik, Chunhua Li, Miguel Pruneda, David Broido, and Pablo Ordejón.

[The elphbolt *ab initio* solver for the coupled electron-phonon Boltzmann transport equations.](#)

npj Computational Materials.

- 2021 Zhe Cheng, Weifang Lu, Jingjing Shi, Daiki Tanaka, **Nakib H. Protik**, Shangkun Wang, Motoaki Iwaya, Tetsuya Takeuchi, Satoshi Kamiyama, Isamu Akasaki, Hiroshi Amano, and Samuel Graham.
[Quasi-Ballistic Thermal Conduction in 6H-SiC](#).
Materials Today Physics.
- 2021 Mauro Fava*, **Nakib Haider Protik***, Chunhua Li, Navaneetha Krishnan Ravichandran, Jesús Carrete, Ambroise van Roekeghem, Georg K. H. Madsen, Natalio Mingo, and David Broido.
[How dopants limit the ultrahigh thermal conductivity of boron arsenide: a first principles study](#).
npj Computational Materials.
- 2020 **Nakib Haider Protik** and Boris Kozinsky.
[Electron-phonon drag enhancement of transport properties from a fully coupled *ab initio* Boltzmann formalism](#).
Physical Review B, 102, 245202.
- 2020 **Nakib Haider Protik** and David Broido.
[Coupled transport of phonons and carriers in semiconductors: A case study of n-doped GaAs](#).
Physical Review B, 101, 075202 [Editors' Suggestion].
- 2019 Xueyuan Wu*, Jiantao Kong*, **Nakib Haider Protik***, David Broido, and Krzysztof Kempa.
[Tailoring the electron-phonon interaction with metallic plasmonic structures](#).
In *Materials Today Physics* 8, 86-91.
- 2017 **Nakib Haider Protik**, Ankita Katre, Lucas Lindsay, Jesús Carrete, Natalio Mingo, and David Broido.
[Phonon thermal transport in 2H, 4H and 6H silicon carbide from first principles](#).
In *Materials Today Physics* 1C, 31-38.
- 2016 **Nakib Haider Protik**, Jesús Carrete, Nebil A. Katcho, Natalio Mingo, and David Broido.
[Ab initio study of the effect of vacancies on the thermal conductivity of boron arsenide](#).
In *Physical Review B* 94, 045207.
- 2014 G. Orlando, C. R. McDonald, **N. H. Protik**, G. Vampa, and T. Brabec.
[Tunneling time, what does it mean?](#)
In *Journal of Physics B* 47, 204002.
- 2014 G. Orlando, C. R. McDonald, **N. H. Protik**, and T. Brabec.
[Identification of the Keldysh time as a lower limit for the tunneling time](#).
In *Physical Review A* 89, 014102.

Invited/Long Talks

- 2024 **Nakib Haider Protik**.
Probing the transport of the interacting electron-phonon system self-consistently and *ab initio*.
At [DPG Meeting](#), Berlin, March 19.
- 2022 **Nakib Haider Protik**.
Coupled transport of the interacting electron-phonon gas – state of the art and the future.
At Solid State Seminar, Institute of Solid State Physics and Institute of Theoretical Physics, University of Bremen, Bremen, November 1.
- 2021 **Nakib Haider Protik**, Chunhua Li, Miguel Pruneda, David Broido, and Pablo Ordejón.
[elphbolt - A free software for coupled electron-phonon Boltzmann transport](#). Video [here](#).
At International Workshop on Advanced Materials-to-Device Solutions for Synaptic Electronics, Session 4, Barcelona, November 12.

Other Talks

- 2023 **Nakib Haider Protik**.
Dragful electron-phonon transport – elphbolt a year and a half on.
At [HoW exciting! 2023](#), Berlin, August 9.
- 2023 **Nakib Haider Protik** and Claudia Draxl.
When does the Tamura model of phonon-isotope scattering break down?.
At [DPG Meeting](#), Dresden, March 27, 2023.
At [APS March Meeting](#), Virtual, March 21.

- 2022 **Nakib Haider Protik** and Claudia Draxl.
[Electron-phonon drag in MgB₂](#).
At DPG Meeting, Regensburg, September 7.
- 2022 **Nakib Haider Protik**, Chunhua Li, Miguel Prudena, David Broido, and Pablo Ordejón.
[elphbolt: An ab initio solver for the coupled and decoupled electron and phonon Boltzmann transport equations](#).
At APS March Meeting, March 15.
- 2021 **Nakib Haider Protik** and Boris Kozinsky.
[Electron-phonon drag enhancement of transport properties from fully coupled *ab initio* Boltzmann formalism](#).
At APS March Meeting, Online, March 17.
- 2019 **Nakib Haider Protik**, Mauro Fava, Natalio Mingo, Jesús Carrete, George Madsen, Navaneetha Ravichandran and David Broido.
[Effect of substitutional defects on the thermal conductivity of boron arsenide](#).
At APS March Meeting, Boston, March 4.
- 2018 **Nakib Haider Protik** and David Broido.
[Effect of plasmon-LO phonon coupling on the mobility of GaN](#).
At APS March Meeting, Los Angeles, March 7.
- 2017 **Nakib Haider Protik**, Ankita Katre, Lucas Lindsay, Jesús Carrete, Bonny Dongre, George K. H. Madsen, Natalio Mingo, David Broido.
[Phonon thermal transport in 2H, 4H and 6H silicon carbide from first principles](#).
At APS March Meeting, New Orleans, March 13.
- 2016 **Nakib Haider Protik**, Jesús Carrete, Natalio Mingo, Nebil A. Katcho and David Broido.
[Ab initio study of the effect of vacancies on the thermal conductivity](#).
At APS March Meeting, Baltimore, March 15.
- 2014 **Nakib Haider Protik**.
Quantum Manybody Physics (Or what I've been up to since I left BRACU).
At BRAC University, Dhaka, June 19.
- 2013 **Nakib Haider Protik**.
Manybody Quantum Dynamics.
At Ottawa-Carleton Institute of Physics Graduate Symposia, Ottawa, April 30.
- 2010 **Nakib Haider Protik** and Arshad Momen.
Simulating the Topologically Massive Maxwell Theory on the Moyal Plane.
At International Conference on Recent Advance in Physics - 2010, Dhaka, March 29. Technical Session 4B: Statistical and Theoretical Physics - 1.
- 2009 Arshad Momen and **Nakib Haider Protik**.
Simulating the Abelian Chern-Simons Theory on the Moyal Plane.
At Physics Conference, TIM - 09, Timisoara, November 27. Section: Theoretical and Computational Physics.

II Teaching

- **Teaching Assistant @ Boston College**

Quantum Physics I: generating homework solutions and grading.

Intro to Physics Recitation I, II: recitations and grading.

1st year physics labs: experiments demonstration and lab report grading.

- **Teaching Assistant @ University of Ottawa**

Fundamentals of Applied Physics III: grading.

Advanced Optics & Introduction to Photonics: grading.

Principles of Physics I: recitations and grading.

Electricity and Magnetism: recitations and grading.

Fundamentals of Physics for Engineers: recitations and grading.

1st year physics lab: experiments demonstration and lab report grading.

- **Teaching Assistant @ BRAC University**

Applied Physics Lab I: lab management, experiments demonstration, exam preparation and grading.

Principles of Physics I, II labs: lab management, experiments demonstration, exam preparation and grading.

Mathematics II lab: lectures, exam preparation and grading.

- **Lab Assistant @ BRAC University**

Physics Lab I, III: experiments demonstration and lab report grading.

III Service

PhD thesis committee member

- International expert and jury member in Dr. Martí Raya Moreno's PhD dissertation committee at Universitat Autònoma de Barcelona.

Thesis title: *Heat transport in binary semiconductor polytypes and devices based on 2D materials: an ab initio study.*

Journal reviewer

- *Physical Review Letters, Physical Review B, Physical Review Materials, Materials Today Physics, Acta Physica Polonica A, Journal of Physics and Chemistry of Solids*

Other

- Student representative in Graduate Affairs Committee (2018-2019), Boston College.
- Graduate Teaching Committee liaison person (2017-18), Boston College.