Dániel Varjas

Contact Information	Budapest University of Technology and Economics, Department of Theoretical Physics Budafoki út 8. 1111 Budapest Hungary

Education

2016 Ph.D., Physics

> University of California, Berkeley, USA
>
> "Geometry, topology, and response in condensed matter systems"

2011 M.Sc., Engineering Physics

> Budapest University of Technology and Economics, Hungary
>
> *Summa Cum Laude*
>
> "Effects of Magnetic Anisotropy in Classical Heisenberg Pyrochlore Antiferromagnet"

Professional Appointments

Senior Research Associate — 2024 –

> Budapest University of Technology and Economics,
> Budapest, Hungary

Researcher — 2023 –

> Leibniz Institute for Solid State and Materials Research,
> Dresden, Germany

Guest Scientist — 2022 – 2023

> Max Planck Institute for the Physics of Complex Systems,
> Dresden, Germany

Researcher — 2020 – 2022

> Department of Physics
> Stockholm University, Sweden

Postdoctoral Researcher — 2016 – 2020

> QuTech and Kavli Institute of Nanoscience
> Delft University of Technology, The Netherlands

Peer-reviewed Journal Publications

1. Quentin Marsal, **Dániel Varjas** and Adolfo G. Grushin
   "Obstructed insulators and flat bands in topological phase-change materials"
   Phys. Rev. B **107**, 045119 (2023)

2. P. Corbae, S. Ciocys, **D. Varjas**, S. Zeltmann, C. H. Stansbury, M. Molina-Ruiz, Z. Chen, L.-W. Wang, A. M. Minor, A. G. Grushin, A. Lanzara and F. Hellman
   "Observation of spin-momentum locked surface states in amorphous Bi_2Se_3"
   Nature Materials **22**, 200–206 (2023)

3. Isidora Araya Day, Anton R. Akhmerov and **Dániel Varjas**
   "Topological defects in a double-mirror quadrupole insulator displace diverging charge"
   SciPost Phys. Core 5, 053 (2022)

4. Kang Yang, **Dániel Varjas**, Emil J. Bergholtz, Sid Morampudi and Frank Wilczek
   "Exceptional dynamics of interacting spin liquids"
   Phys. Rev. Research **4**, L042025 (2022)

5. Christoph Fleckenstein, Alberto Zorzato, **Dániel Varjas**, Emil J. Bergholtz, Jens H. Bardarson and Apoorv Tiwari
   "Non-Hermitian topology in monitored quantum circuits"
   Phys. Rev. Research **4**, L032026 (2022)

6. **Dániel Varjas**, Ahmed Abouelkomsan, Kang Yang and Emil J. Bergholtz
   "Topological Lattice Models with Constant Berry Curvature"
   SciPost Phys. 12, 118 (2022)

7. György Frank, **Dániel Varjas**, Péter Vrana, Gergő Pintér and András Pályi
   "Topological charge distributions of an interacting two-spin system"
   Phys. Rev. B **105**, 035414 (2022)

8. ∗ Helene Spring, Anton R. Akhmerov and **Dániel Varjas**
   "Amorphous topological phases protected by continuous rotation symmetry"
   SciPost Phys. 11, 022 (2021)

9. Kim Pöyhönen, **Dániel Varjas**, Michael Wimmer and Anton R. Akhmerov
   "Minimal Zeeman field requirement for a topological transition in superconductors"
   SciPost Phys. 10, 108 (2021)

10. ∗ Quentin Marsal, **Dániel Varjas** and Adolfo G. Grushin
    "Topological Weaire-Thorpe models of amorphous matter"
    Proc. Natl. Acad. Sci. U.S.A. **117** (48) 30260 (2020)

11. **Dániel Varjas**, Michel Fruchart, Anton R. Akhmerov and Pablo Perez-Piskunow
    "Computation of topological phase diagram of disordered $Pb_{1-x}Sn_xTe$ using the kernel polynomial method"
    Phys. Rev. Research **2** 013229 (2020)

12. ∗ **Dániel Varjas**, Alexander Lau, Kim Pöyhönen, Anton R. Akhmerov, Dmitry I. Pikulin and Ion Cosma Fulga
    "Topological phases without crystalline counterparts"
    Phys. Rev. Lett. **123**, 196401 (2019)

13. A. L. Araújo, R. P. Maciel, R. G. F. Dornelas, **D. Varjas**, and G. J. Ferreira
    "Interplay between boundary conditions and Wilson's mass in Dirac-like Hamiltonians"
    Phys. Rev. B **100**, 205111 (2019)

14. Alexander Lau, Rajyavardhan Ray, **Dániel Varjas** and Anton R. Akhmerov
    "Influence of lattice termination on the edge states of the quantum spin Hall insulator monolayer $1T'-$ WTe_2."
    Physical Review Materials **3**, 054206 (2019).

15. ∗ **Dániel Varjas**, Tómas Ö. Rosdahl and Anton R. Akhmerov
    "Qsymm: algorithmic symmetry finding and symmetric Hamiltonian generation"
    New J. Phys. **20**, 093026 (2018)

16. F. K. de Vries, J. Shen, R. J. Skolasinski, M. P. Nowak, **D. Varjas** L. Wang, M. Wimmer, J. Ridderbos, F. A. Zwanenburg, A. Li, S. Koelling, M. A. Verheijen, E. P. A. M. Bakkers and L. P. Kouwenhoven
    "Spin–Orbit Interaction and Induced Superconductivity in a One-Dimensional Hole Gas"
    Nano Lett. 2018, 18, 10, 6483-6488 (2018)

17. ∗ Georg W. Winkler, **Dániel Varjas**, Rafal Skolasinski, Alexey A. Soluyanov, Matthias Troyer, and Michael Wimmer
    "Orbital Contributions to the Electron g Factor in Semiconductor Nanowires"
    Phys. Rev. Lett. **119**, 037701 (2017)

18. **Dániel Varjas**, Fernando de Juan and Yuan-Ming Lu
    "Space group constraints on weak indices in topological crystalline insulators"
    Phys. Rev. B **96**, 035115 (2017)

19. **Dániel Varjas**, Adolfo G. Grushin, Roni Ilan and Joel E. Moore
"Dynamical Piezoelectric and Magnetopiezoelectric Effects in Polar Metals from Berry Phases and Orbital Moments"
Phys. Rev. Lett. **117**, 257601 (2016)

20. **Dániel Varjas**, Fernando de Juan and Yuan-Ming Lu
"Bulk invariants and topological response in insulators and superconductors with nonsymmorphic symmetries"
Phys. Rev. B **92**, 195116 (2015)

21. **Dániel Varjas**, Michael P. Zaletel and Joel E. Moore
"Chiral Luttinger liquids and a generalized Luttinger theorem in fractional quantum Hall edges via finite-entanglement scaling"
Phys. Rev. B **88**, 155314 (2013)

22. V. Kocsis, S. Bordács, **D. Varjas**, K. Penc, A. Abouelsayed, C. A. Kuntscher, K. Ohgushi, Y. Tokura and I. Kézsmárki
"Magnetoelasticity in ACr_2O_4 spinel oxides ($A =$ Mn, Fe, Co, Ni, and Cu)"
Phys. Rev. B **87**, 064416 (2013)

23. S. Bordács, **D. Varjas**, I. Kézsmárki, G. Mihály, L. Baldassarre, A. Abouelsayed, C. A. Kuntscher, K. Ohgushi and Y. Tokura
"Magnetic-Order-Induced Crystal Symmetry Lowering in ACr_2O_4 Ferrimagnetic Spinels"
Phys. Rev. Lett. **103**, 077205 (2009)

PREPRINTS

1. S.T. Ciocys, Q. Marsal, P. Corbae, **D. Varjas**, E. Kennedy, M. Scott, F. Hellman, A.G. Grushin and A. Lanzara
"Establishing Coherent Momentum-Space Electronic States in Locally Ordered Materials"
arXiv:2302.05945 (2023)

2. D. Muñoz-Segovia, P. Corbae, **D. Varjas**, F. Hellman, S.M. Griffin and A.G. Grushin
"Structural spillage: an efficient method to identify non-crystalline topological materials"
arXiv:2301.02686 (2023)

3. **Dániel Varjas**
"Generalizations of the Pfaffian to non-antisymmetric matrices"
arXiv:2209.02578 (2022)

4. Isidora Araya Day, Anastasiia Varentcova, **Dániel Varjas** and Anton R. Akhmerov
"Pfaffian invariant identifies magnetic obstructed atomic insulators"
arXiv:2209.00029 (2022)

5. Gergő Pintér, György Frank, **Dániel Varjas** and András Pályi
"Birth Quota of Non-Generic Degeneracy Points"
arXiv:2202.05825 (2022)

6. György Frank, **Dániel Varjas**, Gergő Pintér and András Pályi
"Weyl-point teleportation"
arXiv:2112.14556 (2022)

7. Muhammad Irfan, Sathish R. Kuppuswamy, **Dániel Varjas**, Pablo M. Perez-Piskunow, Rafal Skolasinski, Michael Wimmer and Anton R. Akhmerov
"Hybrid kernel polynomial method"
arXiv:1909.09649 (2019)

GRANTS AND SCHOLARSHIPS	Bolyai Scholarship of the Hungarian Academy of Sciences	2024 – 2027
	OTKA Young Researcher Grant of the National Research, Development and Innovation Office of Hungary project title: *Amorphous Topological Matter* role: Project leader, grant value: 44 MHUF	2024 – 2028
	Scholarship of the Hungarian Republic (Köztársasági Ösztöndíj)	2009 – 2010
	Scholarship of the Budapest University of Technology and Economics	2009
	Scholarship of the Prime Minister of Hungary	2006

INVITED TALKS, CONFERENCE PARTICIPATION	Geometrical aspects of topological phases of matter: spatial symmetries, fractons and beyond, Simons Center for Geometry and Physics, Stony Brook: invited talk	2022
	Seminar of the Department of Theoretical Physics, Budapest University of Technology and Economics: invited talk	2021
	Condensed Matter Seminar, Niels Bohr Institute: invited talk	2020
	Theory of Condensed Matter on the Plateau seminar, LPS Orsay: invited talk	2020
	Stockholm University/Nordita Condensed Matter Seminar: invited talk	2020
	Physics@Veldhoven, Veldhoven, Netherlands: contributed talk	2020
	Seminar of the Department of Theoretical Physics, Budapest University of Technology and Economics: invited talk	2019
	ITF-Seminar, IFW, Dresden: invited talk	2019
	Workshop "Topological Quantum Matter: From Low-Temperature Physics to Non-Equilibrium Dynamics", Nordita, Stockholm: invited talk	2019
	NanoFront Winter Retreat, Courchevel: contributed talk	2019
	UK-NL Condensed Matter Workshop, Oxford: invited talk	2018
	APS March Meeting, Los Angeles: contributed talk	2018
	Conference "Majorana States in Condensed Matter", Mallorca: contributed talk	2017
	APS March Meeting, New Orleans: contributed talk	2017
	Seminar of the Department of Theoretical Physics, Budapest University of Technology and Economics: invited talk	2016
	APS March Meeting, Baltimore: contributed talk	2016
	APS March Meeting, San Antonio: contributed talk	2015
	APS March Meeting, Denver: contributed talk	2014

TEACHING EXPERIENCE	**Teaching Assistant**	Spring 2014
	Statistical mechanics II (graduate course) Department of Physics University of California, Berkeley	
	Teaching Assistant	Fall 2011 – Fall 2012
	Physics for Scientists and Engineers: Mechanics and wave motion Department of Physics University of California, Berkeley	
	Teaching Assistant	Spring 2009 – Fall 2009
	Physics for Electrical Engineers Department of Physics Budapest University of Technology and Economics	

	Teaching Assistant	Fall 2008

Differential Equations for Physicists
Department of Differential Equations
Budapest University of Technology and Economics

CONFERENCE
ORGANIZATION

Introduction to computational quantum transport with Kwant — 2020

Online workshop with over 300 participants
Speaker and instructor

Virtual Science Forum — 2019 –

A platform for scientific conferences going fully digital
Contributor

STUDENTS
SUPERVISED

Alberto Zorzato, M.Sc. student (KTH) — 2020 –

Supervising research project on non-Hermitian topological phases

Ahmed Abouelkomsan, Ph.D. student (Stockholm University) — 2020 – 2021

Supervised research project on fractional Chern insulators

Isidora Araya Day, M.Sc. student (Delft University of Technology) — 2019 –

"Defect classification of boundary-obstructed topological phases"

Hélène Spring, Ph.D. student (Delft University of Technology) — 2019 –

Supervising research projects on amorphous topological phases

Quentin Marsal, Ph.D. student (École Normale Supérieure de Lyon) — 2019 –

Co-supervising research projects on amorphous materials

André Melo, Ph.D. student (Delft University of Technology) — 2019 –

Supervising research project on amorphous Bi_2Se_3

David Kapm, M.Sc. (Delft University of Technology) — 2019 – 2020

"Analysis of spin dynamics with the kernel polynomial method"

Arthur J. Pruis, B.Sc. (Delft University of Technology) — 2019

"Wurtzite nanowires: band structure and topology"

Joana Fraxanet, M.Sc. (Leiden University) — 2019

"Fractal density of states in graphene quasicrystals"

Lieuwe Locht, B.Sc. (Delft University of Technology) — 2019

"Quasicrystals"

M.S.M. (Max) Hoskam, M.Sc. (Eindhoven University of Technology) — 2018

"Theory and Fabrication of SnTe for Majorana devices"
Supervised the theoretical and numerical part

Tómas Ö. Rosdahl, Ph.D. (Delft University of Technology) — 2017 – 2018

"Symmetries and Boundary Conditions of Topological Materials:
General Theory and Applications"
Supervised one research project including the development of Qsymm

Rafal Skolasinski, Ph.D. (Delft University of Technology) — 2016 – 2018

"Topology, Magnetism, and Spin-Orbit:
A Band Structure Study of Semiconducting Nanodevices"
Supervised two projects on simulations of nanowires

Research Experience	**Research Assistant**	2012 – 2016
	Department of Physics University of California, Berkeley, USA	
	Visiting Research Assistant	Sept. 2008
	Lehrstuhl Experimentalphysik II, Institut für Physik Universität Augsburg, Augsburg, Germany	

Software Development

Qsymm

Symmetry finder and symmetric Hamiltonian generator. Qsymm is an open source Python library that makes symmetry analysis simple.

Role: lead developer

Kwant

Kwant is a free (open source), powerful, and easy to use Python package for numerical calculations on tight-binding models with a strong focus on quantum transport.

Role: contributor

Languages	English	proficient (level C2)
	German	intermediate (level B1)
	Hungarian	native