CONTACT INFORMATION

website: https://www.pks.mpg.de/nqd   *e-mail:*   mgbukov@pks.mpg.de
github: mgbukov   *ORCID:*   0000-0002-3688-9599

RESEARCH INTERESTS

- *Quantum Many-Body Physics:* out-of-equilibrium dynamics, quantum and classical many-body dynamics, quantum simulation, quantum control.

- *Machine Learning in Physics:* reinforcement learning for quantum technologies, unsupervised learning for quantum many-body physics, interplay between statistical mechanics and machine learning, optimization landscapes.

OCCUPATION

(2022–)	Research group leader	Max Planck Institute for the Physics of Complex Systems (MPI-PKS), Germany
(2020–2022)	Junior research group leader (R3, established researcher)	Sofia University, Bulgaria
(2017–2020) *supervisors*	Moore postdoctoral fellow, physics department Prof. Norman Yao, Prof. Ehud Altman	UC Berkeley, USA

EDUCATION

PhD   physics, 2016   Boston University, USA
advisor   Prof. Anatoli Polkovnikov
thesis   *"Floquet Engineering in Periodically Driven Closed Quantum Systems:*
                 from Dynamical Localisation to Ultracold Topological Matter"

M. Sc.   physics, 2013 *(with high distinction)*   Ludwig-Maximilians-Universität,
                                                   Technische Universität München, Germany
                 Elite Master Program "Theoretical and Mathematical Physics"
advisors   Prof. Lode Pollet, Prof. Immanuel Bloch
thesis   *"Bose-Fermi Mixtures: a Mean-Field Study"*

B. Sc.   mathematics, 2011   Ludwig-Maximilians-Universität, Germany
advisor   Prof. László Erdős
thesis   *"Rigorous Approach to Bose-Einstein Condensation"*

B. Sc.   physics, 2011   Ludwig-Maximilians-Universität, Germany
advisor   Prof. Stefan Kehrein
thesis   *"Periodically Driven Luttinger Liquids"*

SCIENTIFIC RECOGNITIONS

Memberships

- Fellow of the Young Academy of Europe, elected 2024.   MPI-PKS

Fellowships

- Marie Sklodowska-Curie individual fellowship, 2020.   Sofia U
  European Research Executive Agency, European Commission.
- Moore Foundation's independent postdoctoral fellowship, 2017.   UC Berkeley
  "special postdoctoral positions offered by six leading US centers for theoretical condensed matter physics"

Prizes and scholarships

- Alvaro Roccaro Memorial Prize, 2017.   Boston U
  "in recognition of outstanding achievement overall in physics by a graduate student".
- Gertrude and Maurice Goldhaber Prize, 2015.   Boston U
  "in recognition of outstanding achievement by a first-year graduate student".
- DAAD Prize (German Academic Exchange Service), 2012.   LMU Munich
  "for the outstanding achievements of a foreign student at German universities".
- Stipendium aus Mitteln des Bayerischen Staates, 2009-13.   LMU Munich
  Bavarian State Ministry of Sciences Research and the Arts.

Awards

- John V. Atanasoff President Award, 2023.   MPI-PKS
  "for outstanding contributions to the field of artificial intelligence applied to quantum technologies",
  Office of the President of the Republic of Bulgaria.
- Outstanding Editorial Board Member, 2022.   MPI-PKS
  *"selected based on workload, efficiency and quality of manuscript assessments, journal advocacy, and
  involvement in additional editorial projects", Communications Physics – Nature*.
- *highly commended:* International Quantum Technology Emerging Researcher Award   Sofia U
  IOP Publishing, 2020.
- Reviewer of the Month, 2019.   UC Berkeley
  "for exceptional contributions to peer review", Communications Physics – Nature.

SCIENTIFIC SOFTWARE DEVELOPMENT

Co-developer of **QuSpin**: a widely used open-source python library for nonequilibrium quantum dynamics of
boson, fermion and spin many-body systems.
downloads: over 17 200, Anaconda Cloud (1/1/2024)   *website:* http://quspin.github.io/QuSpin/
publications: SciPost Phys. 2, 003 (2017) [>400 citations], SciPost Phys. 7, 020 (2019) [>300 citations]

PUBLICATIONS

Complete up-to-date list available on arXiv.

Bibliometrics: 55 scientific articles *Google scholar:* over 5600 citations, *h*-index 26 (1/12/2024):

- 1 in Nature Physics (co-corresponding author, conceived and supervised the theoretical work)
- 1 in Nature Machine Intelligence (corresponding author, conceived and supervised the research)
- 8 in Physical Review X (three first-author, two second-author, two last author)
- 6 in Physical Review Letters (two first-author, two second-author, two last-author)
- 2 in PRX Quantum (one second, one last and corresponding author)
- 3 in Physical Review Research (one second author, one third author, one last author)
- 9 in Physical Review B (one single-author, three first-author, three second-author, two last author)
- 2 in Physical Review A (first-author)
- 4 in SciPost Physics (one first author, two second-author, one third author)
- 1 in ML: Science & Technology (co-last author)
- 3 in Mathematical and Scientific Machine Learning (one second author, one middle author, one last author)
- 2 in Physics Reports (one second and corresponding author, one second author)
- 1 in Advances in Physics (first and corresponding author)
- 12 preprints under peer review

INVITED SCIENTIFIC TALKS AND LECTURES

Metrics: 92 invited international scientific talks across Europe, North America, and Asia (1/10/2024).

- 33 invited conference and workshop talks   ■ 2 invited talks in industry

- 52 invited talks at academic institutions
- 1 invited public talk
- 5 invited guest lectures

SUPERVISION & MENTORSHIP

- **Undergraduate interns:**
  current: B. Muñoz Cerro (Stanford)
  past: P. Ebert (TU Dresden). Y. Sun (Harvard), Z. Fu (Shanghai Jiao Tong U), H. Gundlach (Berkeley), P. Köttering (Berkeley), O. Howell (Boston)

- **Bachelor students:** (click on name to retrieve thesis)
  past: G. Aleksandrov (Sofia), H. Tonchev (Sofia)

- **Master students:** (click on name to retrieve thesis)
  current: B. Fanton (ENS-PSL), G. Aleksandrov (Sofia), T. Serafimova (Sofia),
  past: P. Tashev (Sofia)

- **PhD students:**
  current: G. Cemin (MPI-PKS), N. Beato (MPI-PKS), P. M. Schindler (MPI-PKS)
  co-supervising: L. Hahn (MPI-PKS, w/ R. Alert), N. Salmeron (Regensburg, w/ M. Schmitt), J. Walkling (MPI-PKS, w/ R. Moessner)
  past: Y. Shi (Nankai), D. Hahn (MPI-PKS, w/ D. Luitz), H. N. Nguyen (Berkeley, w/ B. Whaley), A. McRoberts (MPI-PKS, w/ R. Moessner), J. Yao (Berkeley, w/ L. Lin), F. Metz (OIST, w/ T. Busch)

- **Postdocs:**
  current: A. Solfanelli (MPI-PKS), S. Mondal (MPI-PKS), M. Sonner(MPI-PKS), S. Nandy (MPI-PKS), P. Lenggenhager (MPI-PKS)
  past: P. Patil (MPI-PKS), C. Fleckenstein (KTH w/ J. Bardarson)

INTERNATIONAL TEACHING EXPERIENCE

Lecturer

2024-25	Many-Body Quantum Dynamics (lecture course, 5 ECTS)	TU Dresden
2023-24	Many-Body Quantum Dynamics (lecture course, 5 ECTS)	TU Dresden
2020-21	Introduction to Deep Reinforcement Learning (lecture course, 6 ECTS)	Sofia U
2020-21	Applications of Reinforcement Learning in the Physical Sciences (seminar, 3 ECTS)	Sofia U

Teaching assistant

2013-15	General Physics I, General Physics II, Physics of Health.	Boston U
2009-12	Mathematical Methods for Physics, Theoretical Mechanics, Electrodynamics, Quantum Mechanics 1, Physics Laboratory Course for Chemistry Students.	LMU Munich

INTERNATIONAL RESEARCH EXPERIENCE

2022-	Condensed Matter Division		MPI-PKS
2020-22	Department of Theoretical and Mathematical Physics		Sofia U
2017-20	Condensed Matter Theory Center		UC Berkeley
2016-17	Statistical Physics and Biophysics Group	*Prof. Pankaj Mehta*	Boston U
2014-15	Condensed Matter Theory Group	*Prof. Eugene Demler*	Harvard U
2013-17	Nonequilibrium Dynamics Group	*Prof. Anatoli Polkovnikov*	Boston U
2011-13	Quantum Many-Body Systems Group	*Prof. Lode Pollet*	LMU Munich
2010-11	Condensed Matter Theory Group	*Prof. Stefan Kehrein*	LMU Munich

INSTITUTIONAL RESPONSIBILITIES

2021-	Member of the Scientific Committee	MPI-PKS
2021-	Organizer, Condensed Matter Division Seminar Series	MPI-PKS
2018-20	Co-organizer, Moore Foundation Bay Area Young Investigator Network Events	UC Berkeley
2015-17	Organizer, Condensed Matter Theory Seminar	Boston U
2014-17	Member of the Graduate Student Council	Boston U

SERVICE TO THE COMMUNITY

Member of the advisory board

• Center for Quantum Technologies, Sofia University (2024-present).

Editorial board member

• Communications Physics – Nature (2021-present), responsible for machine learning in physics submissions.

Reviewer

• *Scientific grant review:* ERC (ERCEA), MSCA (REA), QuantERA (Agence Nationale de la Recherche, France), NSERC (Natural Sciences and Engineering Research Council of Canada), Swiss NSF, Israeli Science Foundation, Fondecyt-Chile, Mitacs Accelerate (Canada).

• *Referee/reviewer for scientific journals:* Science, Nat. Machine Intelligence, Nat. Communications, NPJ Quantum Information, Communications Physics, PRX, PRL, PRX Quantum, PRA, PRB, PRE, PR Applied SciPost, New Journal of Physics, Annalen der Physik, Annals of Physics, Computer Physics Communications, Quantum Machine Intelligence, and others.

PhD defense committee member / external reader

• Andrea Solfanelli (SISSA, 2024), Lorenzo Correale (SISSA, 2023), Rajat Panda (SISSA, 2023)

Mentor

• Sofia University's EURAXESS Mentoring Program for last-year MSc and PhD students (2022).

Conference, workshop & school co-organization

• quant24 school for MSc students: From Quantum Matter to Light (MPI-PKS, Dresden 2024)
• quant23 school for MSc students: Quantum Dynamics – Fundamentals and Realizations (MPI-PKS, 2023)
• quant22 school for MSc students: From quantum matter to quantum computers (MPI-PKS, Dresden 2022)
• Quantum Physics & Machine Learning track at Machine Learning Days 2022 (EPFL, Lausanne)

PUBLIC ENGAGEMENT

External adviser

• Republic of Bulgaria Ministry of Education and Science, Directorate for Science (2022–).

RESEARCH FUNDING

Project title	Funding source	Amount	Years	Role	Host institution
Machine Learning to Tailor Correlated States of Matter	Individual Research Grant, German Research Foundation (DFG)	EUR 250 619	2024-2027	principal investigator	MPI-PKS
Nonequilibrium Many Body Control of Quantum Simulators	ERC Starting Grant, European Research Council	EUR 1 500 000	2023-2028	principal investigator	MPI-PKS
Phase Transitions of Quantum Control	Marie Sklodowska-Curie Actions, European Research Executive Agency	EUR 121 814	2021-2022	principal investigator	Sofia University
Reinforcement Learning to Control Quantum Matter away from Equilibrium	VIHREN frontier research grant, Bulgarian National Science Fund	EUR 526 580	2020-2021	principal investigator	Sofia University