CV MARIN BUKOV

CONTACT INFORMATION

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

OCCUPATION

(2022–) Research group leader (E15, fixed-time contract) Max Planck Institute for the Physics of Complex Systems (MPI-PKS), Germany

(2020–2022) Junior research group leader (R3, established researcher) Sofia University, Bulgaria

RESEARCH INTERESTS

- *Quantum Many-Body Physics:* out-of-equilibrium dynamics, quantum many-body physics, quantum simulation, quantum control.
- *Machine Learning in Physics:* reinforcement learning for manipulation of quantum systems, optimization landscapes, interplay between statistical mechanics and machine learning.

EDUCATION

Postdoc physics dept., 2017–2020 UC Berkeley, USA
supervisors Prof. Norman Yao, Prof. Ehud Altman
Gordon and Betty Moore Foundation's independent postdoctoral fellowship

PhD physics, 2016/17 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"*

Abitur Allgemeine Hochschulreife (*Bildungsinländer*), 2008 Galabov-Gymnasium, Bulgaria
Matura Bulgarian state examination, 2008 Galabov-Gymnasium, Bulgaria

SCIENTIFIC RECOGNITIONS

FELLOWSHIPS

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

PRIZES and SCHOLARSHIPS

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

AWARDS

- *highly commended:* International Quantum Technology Emerging Researcher Award Sofia
  IOP Publishing, 2020.
- Reviewer of the Month, 2019. Berkeley
  "for exceptional contributions to peer review", Communications Physics.

PUBLICATIONS (see also appended list)

Bibliometrics: 32 scientific articles *Google scholar:* over 3300 citations, h-index 21 (1/9/2022):

- 6 in Physical Review X (three first-author, two second-author, one last author)
- 4 in Physical Review Letters (two first-author, one second-author, one last-author)
- 6 in Physical Review B (three first-author, one single-author, two last author)
- 2 in Physical Review A (first-author)
- 3 in SciPost Physics (one first author, two second-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 second author, one second author)
- 1 in Advances in Physics (first and corresponding author)
- 5 preprints under peer review (all last author)

INVITED SCIENTIFIC PRESENTATIONS AND LECTURES

Metrics: 51 invited international scientific talks across Europe, North America, and Asia (1/9/2022).

- 17 invited conference and workshop talks
- 31 invited talks at academic institutions
- 2 invited talks in industry
- 1 invited lecture

SCIENTIFIC SOFTWARE DEVELOPMENT

Co-developer of **QuSpin** (with P. Weinberg and M. Schmitt): a **widely used** open-source python library for nonequilibrium quantum dynamics of boson, fermion and spin many-body systems.
downloads: 10 129, Anaconda Cloud (1/8/2022)
website: http://weinbe58.github.io/QuSpin/
publications: SciPost Phys. 2, 003 (2017) [over 200 citations], SciPost Phys. 7, 020 (2019) [over 150 citations]

(CO-) SUPERVISED STUDENTS

- **Bachelor students:**
  current: Georgi Aleksandrov (Sofia)
  past: Hristo Tonchev (2022, Sofia), Hans Gundlach (2021, Berkeley), Paul Köttering (2021, Berkeley), Owen Howell (2017, Boston)
- **Master students:**
  current: Pavel Tashev (Sofia), S. Petrov (Sofia), Hristo Tonchev (Sofia).

- **PhD students:** (joint supervision denoted in parentheses)
  current: N. Beato (MPI-PKS), P. Schindler (MPI-PKS), D. Hahn (MPI-PKS, w/ D. Luitz), A. McRoberts (MPI-PKS, w/ R. Moessner), H. N. Nguyen (Berkeley, w/ B. Whaley), J. Yao (Berkeley, w/ L. Lin)
  past: F. Metz (2020-22, OIST, w/ T. Busch), C. Fleckenstein (2018-20, Würzburg, w/ B. Trauzettel)
- **Postdocs:**
  current: P. Patil (MPI-PKS)

INTERNATIONAL TEACHING EXPERIENCE

LECTURER

(2020-21)	Introduction to Deep Reinforcement Learning (lecture course).	Sofia
(2020-21)	Applications of Reinforcement Learning in the Physical Sciences (student seminar).	Sofia

TEACHING ASSISTANT

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

INTERNATIONAL RESEARCH EXPERIENCE

RESEARCHER

(2022-)	Condensed Matter Division		MPI-PKS
(2020-22)	Department of Theoretical and Mathematical Physics		Sofia
(2017-20)	Condensed Matter Theory Center		Berkeley
(2016-17)	Statistical Physics and Biophysics Group	*Prof. Pankaj Mehta*	Boston
(2014-15)	Condensed Matter Theory Group	*Prof. Eugene Demler*	Harvard
(2013-17)	Nonequilibrium Dynamics Group	*Prof. Anatoli Polkovnikov*	Boston
(2011-13)	Quantum Many-Body Systems Group	*Prof. Lode Pollet*	Munich
(2010-11)	Condensed Matter Theory Group	*Prof. Stefan Kehrein*	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	Berkeley
2015-17	Organizer, Condensed Matter Theory Seminar	BU
2014-17	Member of the Graduate Student Council	BU

COMMUNITY SERVICE

EDITORIAL BOARD MEMBER

- Communications Physics – Nature (2021-present).

REVIEWER

- *Scientific grant review:* ERC StG 2022 (ERCEA), QuantERA 2022 (Agence Nationale de la Recherche, France), Mitacs Accelerate (Canada), Israeli Science Foundation (Israel).
- *Referee/reviewer for scientific journals:* Science, Nature Machine Intelligence, Nature Communications, NPJ Quantum Information, Communications Physics, Physical Review X, Physical Review Letters, Physical Review X Quantum, Physical Review A, Physical Review B, Physical Review E, Physical Review Applied, SciPost, New Journal of Physics, Annalen der Physik, Annals of Physics, Computer Physics Communications, Quantum Machine Intelligence, and others.

MENTOR

- Sofia University's Mentoring Program for last-year master's, PhD, and postdoctoral students (2022).

CONFERENCE, WORKSHOP & SCHOOLS CO-ORGANIZATION

- Quantum Physics & Machine Learning track at Machine Learning Days 2022 (EPFL, Lausanne)
- quant22 school for master students: From quantum matter to quantum computers (MPI-PKS, Dresden 2022)

RESEARCH FUNDING

Project title	Funding source	Amount	Year	Role
Reinforcement Learning to Control Quantum Matter away from Equilibrium	VIHREN frontier research grant, Bulgarian Science Fund (BNSF)	EUR 526 580	2020-2021	principal investigator
Phase Transitions of Quantum Control	Marie Skłodowska-Curie Actions, European Research Executive Agency	EUR 121 814	2021-2022	principal investigator

REFERENCES

- Prof. Immanuel Bloch (immanuel.bloch@mpq.mpg.de)
- Prof. Eugene Demler (demlere@phys.ethz.ch)
- Prof. Nathan Goldman (nathan.goldman@ulb.be)
- Prof. Lin Lin (linlin@math.berkeley.edu)
- Prof. Pankaj Mehta (pankajm@bu.edu)
- Prof. Roderich Moessner (moessner@pks.mpg.de)
- Prof. Anatoli Polkovnikov (asp@buphy.bu.edu)

INVITED INTERNATIONAL CONFERENCE / WORKSHOP PRESENTATIONS

scientific meetings and symposia:

1. *Tensor-Network based Quantum Many-Body Control using Reinforcement Learning*, CASUS conference, Uniwersytet Wroclawski, Wroclaw 13 July 2022

2. *Reinforcement Learning for Quantum Control.*
   Condensed matter physics and materials science assisted by machine learning: potential, reSofialts and challenges, UKRAPRO workshop, IFW Dresden, Jun 1, 2022.

3. *Reinforcement Learning Many-Body Ground State Preparation based on Counter-Diabatic Driving.*
   Quantum Information and Computation: From Foundations to Applications, IIT Jodhpur, virtual, India, Oct 19, 2021.

4. *Floquet engineering with strongly correlated systems.*
   Interacting Topological Matter: Atomic, Molecular and Optical Systems, KITP workshop, Santa Barbara, USA, June 7, 2021.

5. *Reinforcement Learning Many-Body Ground State Preparation based on Counter-Diabatic Driving.*
   APS March Meeting (invited talk), virtual, USA, Mar 15, 2021.

6. *(Pre-)thermalization in periodically-driven systems: a quantum or classical phenomenon?*
   Thermalization, Many-Body Localization, and Hydrodynamics, ICTS, Bengaluru, India, Nov 19, 2019.

7. *Glassy and Correlated Phases of Quantum Control.*
   Machine Learning for Quantum Design, Perimeter Institute, Waterloo, Canada, Jul 12, 2019.

8. *Reinforcement Learning to Prepare Quantum States Away from Equilibrium.* Machine Learning for Quantum Technology, Max-Planck Institute for the Science of Light, Erlangen, Germany, May 8, 2019.

9. *Reinforcement Learning to Control Quantum Systems away from Equilibrium.*
   Machine Learning for Quantum Many-Body Physics, KITP workshop, Santa Barbara, USA, Feb 26, 2019.

10. *Reinforcement Learning to Prepare Quantum States Away from Equilibrium.*
    Machine Learning and Statistical Physics, CUNY, New York, USA, Nov 13, 2018.

11. *Reinforcement Learning: Introduction and Applications to Nonequilibrium Dynamics.*
    The Dynamics of Quantum Information, KITP workshop, Santa Barbara, USA, Oct 22, 2018.

12. *Glassy and Correlated Quantum Control Phases.*
    "Non-thermal Quantum Systems", Boston, USA, Mar 10-14, 2018.

13. *Reinforcement Learning in Phases of Quantum Control.*
    "Second Physics Informed Machine Learning" (LANL), Sante Fe, USA, Jan 21-26, 2018.

14. *Reinforcement Learning in Phases of Quantum Control.*
    Workshop on "Artificial Intelligence and Quantum Physics", Nanjing University, China Dec 19-22, 2017.

15. *What can Reinforcement Learning Teach us about Quantum State Preparation? The Phase Diagram of Quantum Control.*
    "645. WE-Heraeus Seminar" (best poster winner invited talk), Bad Honnef, Germany, Jun 21, 2017.

16. *The Phase Diagram of the Quantum State Preparation Problem: a Reinforcement Learning Study.*
    "Dynamics and Hydrodynamics of Certain Quantum Matter", CUNY, New York, USA, Mar 20, 2017.

17. *What can Reinforcement Learning Teach us about Quantum State Preparation?* "Quantum Dynamics: from Models to Materials", Aspen Center for Theoretical Physics, USA, Jan 16, 2017.

industry:

1. *Reinforcement Learning to Manipulate Quantum Matter.* Google X, Mountain View, USA, Apr 3, 2020.

2. *Reinforcement Learning and Quantum Control.* Unlearn.AI, start-up, San Francisco, USA, Apr 17, 2018.