

Programme of
**Humboldt Kolleg on Synthetic
Quantum Matter**
2-6 July 2023



Alexander von
HUMBOLDT
STIFTUNG

To be held at **Hotel** Courtyard by Marriott Vilnius City Center Rinktinės st. 3, Vilnius, Lithuania

Sunday, July 2nd



Arrival of the participants of the Kolleg

16:00 – 18:30

Walking excursion in Vilnius

2 h 30 min

Meeting point at the Hotel

18:30 – 19:30

Registration at the Hotel

45 min

19:00 – 22:00

Welcome party at the Hotel

3 h

Monday, July 3rd

8:00 – 8:40

Registration

40 min

8:30 – 9:15

Opening of the Kolleg

45 min

★ **Chair Gediminas Juzeliūnas (Vilnius University, Lithuania)**

8:30 – 8:45

Opening remarks by

Rimvydas Petrauskas (Rector of Vilnius University)

Peter Buschmann (Deputy Head of Mission, Embassy of the Federal Republic of Germany)

Aidas Matijošius (Dean of Faculty of Physics, Vilnius University)

Gediminas Juzeliūnas (Chairmen of Humboldt Kolleg, Vilnius University)

8:45 – 9:15

Rebecca Großmann

(Programme Director, Division Europe, Alexander von Humboldt Foundation, Bonn)

Alexander von Humboldt Foundation – Programmes and Activities

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To be held at **Hotel** Courtyard by Marriott Vilnius City Center Rinktinės st. 3, Vilnius, Lithuania

Monday, July 3rd

9:15 – 10:30

Session 1

1 h 15 min

★ Chair Marek Kuś (University of Warsaw, Poland)

9:15 – 9:40

Gershon Kurizki (Weizman Institute, Israel)
Nonlinear Filtering of Quantum Noise for Sensing and Work

9:40 – 10:05

Kazimierz Rzążewski (Centre for Theoretical Physics, PAN, Warsaw)
The Fock States Sampling method at work

10:05 – 10:30

Eugene Demler (ETH Zurich, Switzerland)
Quantum Simulations of the Fermi Hubbard model

10:30 – 11:10

Coffee break

40 min

11:10 – 12:25

Session 2

1 h 15 min

★ Chair Mārcis Auziņš (University of Latvia)

11:10 – 11:35

Karol Życzkowski (Jagiellonian University, Krakow, Poland)
Synthetic Quantum states: maximal entanglement between arbitrary selected subsystems

11:35 – 12:00

Florian Mintert (Imperial College London)
Quantum simulations of time-dependent Hamiltonians

12:00 – 12:25

Michael Fleischhauer (University of Kaiserslautern, Germany)
To thermalize or not? Slow particle diffusion in Many-Body Localization

12:25 – 14:00

Lunch break

1 h 35 min

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Monday, July 3rd

14:00 – 15:15

Session 3



1 h 15 min

★ **Chair Jan Mostowski** (Institute of Physics, PAN, Warsaw, Poland)

14:00 – 14:25



André Eckardt (TU Berlin, Germany)

Floquet engineering of open quantum systems



14:25 – 14:50



Cheng Chin (University of Chicago, USA)

Bose Enhanced Quantum Chemistry in Atomic and Molecular Condensates



14:50 – 15:15



Ite Albert Yu (National Tsing Hua University, Taiwan)

Stationary Dark-State Polaritons Dressed by Rydberg Dipole-Dipole Interaction – A Feasible Platform for the Polariton Bose-Einstein Condensation



15:15 – 15:50

Coffee break



35 min

15:50 – 17:30

Session 4



1 h 40 min

★ **Chair Mariusz Gajda** (Institute of Physics, PAS, Warsaw, Poland)

15:50 – 16:15



Emilia Witkowska (Institute of Physics, PAS, Warsaw, Poland) *Scalable spin squeezing in isotropic Heisenberg spin chains with nearest neighbour interactions*



16:15 – 16:40



Natalia Korolkova (University of St Andrews, UK)

Coherent Diffusive Photonics: Quantum engineering by nonlocal loss



16:40 – 17:05



Ludwig Mathey (University of Hamburg, Germany)

Rotation sensor, critical dynamics and Rydberg quantum gates based on ultracold atom systems



17:05 – 17:30



Nikolay V Vitanov (Sofia University, Bulgaria)

Quantum Control of Qubits on IBM Quantum



17:30 – 19:30

Poster session (see page 8)



2 h

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To be held at **Hotel** Courtyard by Marriott Vilnius City Center Rinktinės st. 3, Vilnius, Lithuania

Tuesday, July 4th

8:55 – 9:00

Conference information

5 min

9:00 – 10:15

Session 5

1 h 15 min

★ **Chair Vytautas Klimavičius** (Vilnius University, Lithuania)

9:00 – 9:25



Reiner Blatt (University of Innsbruck, Austria)



Quantum Computation and Quantum Simulation with Strings of Trapped Ca⁺ Ions

9:25 – 9:50



Florian Schreck (University of Amsterdam)



Continuous Bose-Einstein condensation and superradiant clocks

9:50 – 10:15



Christof Weitenberg (University of Hamburg, Germany)



Matter-wave microscopy of ultracold atoms in tunable optical lattices

10:15 – 10:50

Coffee break

35 min

10:50 – 12:30

Session 6

1 h 40 min

★ **Chair Wen-Te Liao** (National Central University, Taoyuan, Taiwan)

10:50 – 11:15



Nir Davidson (Weizman Institute, Israel)



Simulating XY spins with coupled lasers

11:15 – 11:40



Robert Spreeuw (University of Amsterdam, The Netherlands)



From an Optical Magnus Effect to a Novel Quantum Gate

11:40 – 12:05



Grazia Salerno (Aalto University, Finland)



Topological bound states in the continuum of plasmonic lattices

12:05 – 12:30



Iacopo Carusotto (University of Trento, Italy)



Linear and nonlinear edge dynamics of trapped fractional quantum Hall droplets

12:30 – 12:40

Conference photo

10 min

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Tuesday, July 4th

12:40 – 14:30

Lunch break

1 h 50 min

14:30 – 18:30

Excursion to Trakai castle

4 h

Meeting point at the Hotel

19:30 – 22:00

Conference Dinner

2 h 30 min

At Restaurant Grey (Pilies g. 2, Vilnius) [Directions](#)

Wednesday, July 5th

8:55 – 9:00

Conference information

5 min

9:00 – 10:15

Session 7

1 h 15 min

★ **Chair Teodora Kirova** (University of Latvia)

Laurent Sanchez-Palencia (CNRS, France)

Strongly Interacting Bosons in a Two-Dimensional Quasicrystal Optical Potential



9:25 – 9:50

Krzysztof Jachymski (Warsaw University, Poland)

Charged impurities in a bosonic bath



9:50 – 10:15

Luca Barbiero (Politecnico di Torino, Italy)

Engineering non-local interactions and geometrical frustration in synthetic quantum matter



10:15 – 11:00

Coffee break

45 min

11:00 – 12:15

Session 8

1 h 15 min

★ **Chair Egidijus Anisimovas** (Vilnius University, Lithuania)

Richard Fletcher (MIT, USA)

Quantum Hall physics in a quantum Foucault pendulum



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Wednesday, July 5th

11:25 – 11:50



Peter Krüger (University of Sussex, UK / PTB Berlin, Germany) *Atomic gases as probes: from dimensional crossovers to current-density imaging*



11:50 – 12:15



Oded Zilberberg (University of Konstanz, Germany) *Classical to quantum extended rotating frames*



12:15 - 14:00

Lunch break



1 h 45 min

14:00 – 15:15

Session 9



1 h 15 min

★ **Chair Mažena Mackoitis-Sinkevičienė** (Vilnius University, Lithuania)

14:00 – 14:25



Tilman Pfau (Stuttgart University, Germany) *A molecular bond between ions and Rydberg atoms*



14:25 – 14:50



Krzysztof Sacha (Jagiellonian University, Krakow, Poland) *Absolutely Stable Discrete Time Crystals*



14:50 – 15:15



Matthew Eiles (Institute for Physics of Complex systems, Germany) *Rydberg molecules, composites, and polarons*



15:15 – 16:00

Coffee break



45 min

16:00 – 17:15

Session 10



1 h 15 min

★ **Chair Gediminas Juzeliūnas** (Vilnius University, Lithuania)

16:00 – 16:25



Andrea Alberti (University of Bonn, Germany) *A Quantum Computer Demonstrator with Ultracold Sr Atoms*

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Wednesday, July 5th

★ Chair Gediminas Juzeliūnas (Vilnius University, Lithuania)

16:25 – 16:50



Nur Ünal (University of Cambridge, UK)



Topology in multi-level systems and non-Abelian Floquet braiding

16:50 – 17:15



Stefan Scheel (University of Rostock, Germany)



Non-Abelian geometric phases in integrated photonic waveguide structures

17:15 - 17:30

Closing remarks



15 min



17:30 – 18:30

Break



1 h

18:30 – 21:30

Farewell party at the Hotel



3 h

Thursday, July 6th

Departure of the participants of the Kolleg



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Monday, July 3rd

POSTER SESSION

-  1. **Markus Bestler** (University of Konstanz, Germany)
Quantum Harmonic Balance
-  2. **Michał Bobrowicz** (Jagiellonian University, Poland)
A Particle on a Ring as a Time Crystal
-  3. **Yakov Braver** (Vilnius University, Lithuania)
Construction of Eight-dimensional Topological Systems Based on Time-Space Crystalline Structures
-  4. **Domantas Burba** (Vilnius University, Lithuania)
Topological charge pumping in subwavelength Raman lattices
-  5. **He Chengdong** (Hong Kong University of Science and Technology HKUST, Hong Kong)
Realization of a $SU(2)$ non-Hermitian topological band and the thermodynamic study of imbalanced $SU(N)$ fermions
-  6. **Jacek Dobrzyniecki** (University of Warsaw, Poland)
Quantum simulation of the central spin model with a Rydberg atom and polar molecules in optical tweezers
-  7. **Michael Doris** (Joint Quantum Institute, NIST and University of Maryland, USA)
Machine Learning Applications in Laser Cooling and Trapping Atoms
-  8. **Hubert Dunikowski** (Institute of Physics, Polish Academy of Sciences, Poland)
Nuclear spin squeezing induced by light for fermions in optical lattices
-  9. **Dmitry Efimov** (Wrocław University of Science and Technology, Poland)
Problem of double measurement in creating electronic momentum maps in Strong-Field experiments
-  10. **William Evans** (PTB Berlin, Germany)
The application of optically pumped magnetometer arrays for electric vehicle battery characterization
-  11. **Weronika Golletz** (Jagiellonian University, Krakow, Poland)
 N Impenetrable particles bouncing on a mirror: discrete time crystals
-  12. **Edvinas Gvozdiavas** (Vilnius University, Lithuania)
Interference induced anisotropy in a two-dimensional dark state optical lattice
-  13. **Hamid Reza Hamed** (Vilnius University, Lithuania)
Spatially Strongly Confined Atomic Excitation via Two Dimensional Stimulated Raman Adiabatic Passage
-  14. **Hamid Reza Hamed** (Baltic Institute of Advanced Technology)
Spatially Patterned Light Amplification Without Inversion

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Monday, July 3rd

POSTER SESSION

-  **15. Ali Emami Kopaei** (Uniwersytet Jagielloński, Poland)
Topological molecules and topological localization of a Rydberg electron on a classical orbit
-  **16. Teodora Velcheva Kirova** (University of Latvia, Latvia)
Azimuthal Dependence of Electromagnetically Induced Grating in a Double V-type Atomic System near a Plasmonic Nanostructure
-  **17. Viačeslav Kudriašov** (Vilnius University, Lithuania)
Absorption Patterning in Rydberg Atomic Media Controlled with EIT and OAM Fields
-  **18. Piotr Kulik** (Center for Theoretical Physics, Polish Academy of Sciences, Poland)
Fock State Sampling Method – Characteristic temperature of maximal fluctuations for interacting bosons in box
-  **19. Reinis Lazda** (University of Latvia, Latvia)
Nanotesla Sensitivity Diamond NV Magnetometry
-  **20. Ignas Lukošius** (Vilnius University, Lithuania)
Extremely Narrow, Sharp-Peaked Resonances at the Edge of the Continuum
-  **21. Mažena Mackoitis-Sinkevičienė** (Vilnius University, Lithuania)
Spin-squeezed States with Ultracold Fermions
-  **22. João Pedro Mendonça** (University of Warsaw)
Quantum simulation of extended electron-phonon-coupling models in a hybrid Rydberg atom setup
-  **23. Viktor Novičenko** (Vilnius University, Lithuania)
High-frequency expansion of periodically driven amplitude-modulated quantum systems treated using flow equations
-  **24. Francesco Petiziol** (TU Berlin, Germany)
Nonperturbative Floquet Engineering of the Toric-code Hamiltonian and its Ground State
-  **25. Matas Plūkys** (Vilnius University, Lithuania)
Transverse Modes and Beam Spatial Quality in Microchip Lasers
-  **26. Ville Pyykkönen** (Aalto University, Finland)
Suppression of Nonequilibrium Quasiparticle Transport in Flat-Band Superconductors
-  **27. Yi-Fan Qu** (Institute for Theoretical Physics, ETH Zurich, Zurich, Switzerland)
Quantum Dynamics and Spectral Properties of Fermi Polarons in One and Two-Dimensional Systems
-  **28. Tom Robin Rieckmann** (University Rostock, Germany)
Optimizing State Preparation Circuits on NISQ Platforms using Reinforcement Learning

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Monday, July 3rd

POSTER SESSION

-  **29. Tymoteusz Salamon** (ICFO, Barcelona, Spain)
Synthetic twisted bi-layer materials
-  **30. Alexander Schnell** (Technische Universität Berlin, Germany)
Floquet-topological states in weakly interacting quantum gas mixtures
-  **31. Rokas Silkinis** (Center for Physical Sciences and Technology, Lithuania)
Theoretical Modeling of Vibrationally Resolved Optical Lineshapes of a Carbon-Oxygen Pair Defect in Silicon
-  **32. Lukas Stakėla** (Center for Physical Sciences and Technology, Lithuania)
Terahertz Quantum Optoelectronics in Superlattices
-  **33. Lidia Stocker** (Institute for Theoretical Physics, ETH Zurich, Zurich, Switzerland)
Spinful cavity-double-dot system as a nonlocal Kondo and RKKY phase transition simulator
-  **34. Tomasz Szotkora** (Jagiellonian University, Krakow, Poland)
Discovering Hidden Patterns in Quantum Systems: Unveiling Scar States and Decoupled Subspaces with Quantum Variational Autoencoders
-  **35. Isaac Tesfaye** (TU Berlin, Germany)
Adiabatic charge pumping in bosonic Chen-insulator analogs
-  **36. Gediminas Usevičius** (Vilnius University, Lithuania)
Quantum tunneling of the methyl group in dimethylammonium zinc formate using ESEEM spectroscopy
-  **37. Martin Will** (University of Kaiserslautern, Germany)
Dynamics of polaron formation in 1D Bose gases in the strong-coupling regime
-  **38. Cailean Wilkinson** (University of St Andrews, UK)
Secure tripartite quantum state sharing in the continuous-variable domain
-  **39. Vytautas Žalandauskas** (Center for Physical Sciences and Technology, Lithuania)
Ab Initio Investigation of Vibrational Properties of Divacancy Defects in Silicon Carbide
-  **40. Giedrius Žlabys** (Okinawa Institute of Science and Technology, Japan)
Emergent topological properties of Kronig-Penney-type models

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