Curriculum Vitae

Alexander Wietek
Flatiron Research Fellow
Center for Computational Quantum Physics
Simons Foundation, New York
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Research Topics

- Condensed Matter Theory
- Quantum Many-Body Physics
- Computational Physics
- Frustrated Magnetism
- Strongly Correlated Electrons

Education

University of Innsbruck — Innsbruck, Austria
Ph.D. in Theoretical Condensed Matter Physics, Advisor: Andreas M. Läuchli — 2014-2017
- Thesis: "Topological states of matter in frustrated quantum magnetism"
- Date of graduation: Dec. 14 2017

Technical University of Munich — Munich, Germany
M.Sc. in Mathematics, with highest distinction — 2010–2012

Ludwig-Maximilians University of Munich — Munich, Germany
M.Sc. in Geophysics, with highest distinction — 2011–2013

University of Innsbruck — Innsbruck, Austria
B.Sc. in Technical Mathematics, with highest distinction — 2007–2010

Research Experience

Flatiron Research Fellow — New York City, USA
Center for Computational Quantum Physics, Flatiron Institute, Simons Foundation — 2018 –today
- Proposal of combining the TPQ method with the Lanczos algorithm for finite-temperature simulations
- Solved the problem of peculiar thermodynamic measurements in $SrCu_2(BO_3)_2$
- Developed METTS method to simulate doped and frustrated Hubbard models at finite temperature approaching two dimensions
- Showed emergence of pseudogap and stripe order in the doped Hubbard model using controlled and accurate numerical methods

Doctoral researcher — Innsbruck, Austria
University of Innsbruck, with Prof. Andreas Läuchli — 2014–2017
- Computational research on novel states of matter in quantum many-body systems
- Discovery of chiral spin liquids in frustrated quantum magnetism
- Development of software for massively MPI parallelized Exact Diagonalization and Variational Monte Carlo techniques

Visiting Researcher — Tokyo, Japan
University of Tokyo, with Prof. Synge Todo — 2014–2017

- Numerically exact computer simulations of spin systems with up to 50 Qubits
- Development of directed-loop Quantum Monte Carlo method to study certain SU(N) symmetric systems

Professional Activities

WissensDurst Festival Innsbruck, Austria
Festival Coordinator Innsbruck 2017–2018

- Science festival promoting local research in pubs and bars
- Lead a team of 11 scientists, who organized 12 events in 4 different locations
- More than 800 visitors

Pint of Science Festival Innsbruck, Austria
Organizer of Physics Events 2016

- Worldwide public science festival publicly promoting latest research results
- Organized three evenings with 5 speakers for the physics branch of Pint of Science Innsbruck

Advanced Methods for Strongly Correlated Quantum Systems Innsbruck, Austria
Organizer of workshop for Ph.D. students 2016

- Workshop and conference for 20 Ph.D. students of the DFG research group FOR1807
- Organization of venue, accomodation, transport, and invitation of guest speakers

Referee activities
Regular referee for Physical Review B, Physical Review Letters, and SciPost

Further Experience

GPGPU software developer Aldrans, Austria
Bartenbach Lichtsysteme 2011

- industry internship in research and development
- implementation of parallel raytracer using NVidia CUDA for lighting simulations

Teaching assistant Munich, Germany
Department for Dynamical Systems 2011

- industry internship in research and development
- assistent for course “Stochastic dynamical systems”

Paramedic Zirl, Austria
Austrian Red Cross 206-2007

- Civil service at Red Cross Zirl, training and work as paramedic

Collaborations

Random t-J model, SYK criticality ongoing

- Subir Sachdev, Henry Shackleton (Harvard University, Cambridge, USA)
- Antoine Georges (Flatiron Institute, New York, USA)

Triangular Lattice Hubbard model ongoing

- Michel Ferrero, Fedor Simkovic (École Polytechnique, Paris, France)
- Thomas Schäfer (Max Planck Institute for Solid State Physics, Stuttgart, Germany)

– Antoine Georges, Miles Stoudenmire, Riccardo Rossi (Flatiron Institute, New York, USA)

Thermodynamics in quantum magnetism ongoing

– Miles Stoudenmire (Flatiron Institute, New York, USA)
– Kate Ross (Colorado State University, Fort Collins, USA)
– Chunhan Feng (UC Davis, Davis, USA)

METTS for the Hubbard model ongoing

– Steven R. White (UC Irvine)
– Miles Stoudenmire, Yuan-Yao He, Antoine Georges (Flatiron Institute, New York, USA)

Thermodynamics of $SrCu_2(BO_3)_2$ finished

– Andreas Honecker (Univerité de Cergy-Pontoise, France)
– Philippe Corboz (University of Amsterdam, Netherlands)
– Stefan Wessel (RWTH Aachen University, Germany)
– Bruce Normand (Paul Scherer Institute, Villigen, Switzerland)
– Frederic Mila (EPFL Lausanne, Switzerland)

SU(3) chiral spin liquids finished

– Ji-Yao Chen (Max Planck Institute of Quantum Optics, Garching, Munich)
– Sylvain Capponi, Didier Poilblanc (Université de Toulouse, France)

PRACE supercomputing finished

– Andreas M. Läuchli (University of Innsbruck, Austria)
– Sylvain Capponi (Université de Toulouse, France)

Grants and Awards

- Marietta Blau Stipendium, OeAD, fellowship for conducting research abroad 2016–2017
- Deutschlandstipendium at TU Munich, 2011–2012
- Third Prize at International Mathematics Competition for University Students 2010

Selected scientific talks

Canadian Institute For Advanced Reasearch (CIFAR) Meeting, Invited Talk — New York, USA
Understanding frustrated quantum magnets — 11/2019

"Korrelationstage" at Max-Planck Institute for Complex Systems — Dresden, Germany
Thermodynamics of the Shastry-Sutherland model and $SrCu_2(BO_3)_2$ — 9/2019

International Conference "Recent Progress in Many Body Theories" — Toulouse, France
Thermodynamics of the Shastry-Sutherland model and $SrCu_2(BO_3)_2$ — 9/2019

Condensed Matter Seminar at Jožef Stefan Institute, Invited Talk — Ljubljana, Slovenia
Thermodynamics of the Shastry-Sutherland model and large-scale Exact Diagonalization — 9/2019

CRMQ Seminar, Université de Sherbrooke, Invited Talk — Sherbrooke, Canada
Topological order and thermodynamics of frustrated spin systems — 11/2018

TopMat workshop, Institute de Physique Theorique, Saclay — Paris, France
Numerical identification of quantum spin liquids — 6/2018

Université de Toulouse, IRSAMC seminar, Invited Talk — Toulouse, France
Chiral spin liquids in frustrated magnetism — 4/2018

Numerical Methods for Strongly Correlated Quantum Systems, Invited Talk — Marburg, Germany
High performance computing aspects of Exact Diagonalization — 2/2018

Symposium and workshop on "Theory of Correlated Topological Materials" — Tokyo, Japan
Emergent chiral spin liquids in frustrated magnetism — 2/2017

International Conference on Strongly Correlated Quantum Systems — Würzburg, Germany
Exact Diagonalization techniques and the quest for identifying spin liquids — 2/2015

Publication List

Alexander Wietek
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Preprints

[1] A. **Wietek**, Y.-Y. He, S. R. White, A. Georges, and E. M. Stoudenmire. *Stripes, Antiferromagnetism, and the Pseudogap in the Doped Hubbard Model at Finite Temperature*. (2020). URL: https://arxiv.org/abs/2009.10736.

[2] A. Honecker, J. Richter, J. Schnack, and A. **Wietek**. *Loop-gas description of the localized-magnon states on the kagome lattice with open boundary conditions*. (2020). URL: https://arxiv.org/abs/2008.10614.

[3] A. **Wietek**, M. Schuler, and A. M. Läuchli. *Studying Continuous Symmetry Breaking using Energy Level Spectroscopy*. (2017). URL: https://arxiv.org/abs/1704.08622.

Journal Articles

[4] A. **Wietek** and A. M. Läuchli. "Valence bond solid and possible deconfined quantum criticality in an extended kagome lattice Heisenberg antiferromagnet". In: *Phys. Rev. B* 102, 020411(R) (2020). DOI: 10.1103/PhysRevB.102.020411.

[5] J.-Y. Chen, S. Capponi, A. **Wietek**, M. Mambrini, N. Schuch, and D. Poilblanc. "$SU(3)_1$ Chiral Spin Liquid on the Square Lattice: A View from Symmetric Projected Entangled Pair States". In: *Phys. Rev. Lett.* 125, 017201 (2020). DOI: 10.1103/PhysRevLett.125.017201.

[6] A. **Wietek**, P. Corboz, S. Wessel, B. Normand, F. Mila, and A. Honecker. "Thermodynamic properties of the Shastry-Sutherland model throughout the dimer-product phase". In: *Phys. Rev. Research* 1, 033038 (2019). DOI: 10.1103/PhysRevResearch.1.033038.

[7] G. Carleo, K. Choo, D. Hofmann, J. E. Smith, T. Westerhout, F. Alet, E. J. Davis, S. Efthymiou, I. Glasser, S.-H. Lin, M. Mauri, G. Mazzola, C. B. Mendl, E. van Nieuwenburg, O. O'Reilly, H. Théveniaut, G. Torlai, F. Vicentini, and A. **Wietek**. "NetKet: A machine learning toolkit for many-body quantum systems". In: *SoftwareX* 10, 100311 (2019). DOI: https://doi.org/10.1016/j.softx.2019.100311.

[8] A. **Wietek** and A. M. Läuchli. "Sublattice coding algorithm and distributed memory parallelization for large-scale exact diagonalizations of quantum many-body systems". In: *Phys. Rev. E* 98, 033309 (2018). DOI: 10.1103/PhysRevE.98.033309.

[9] A. **Wietek** and A. M. Läuchli. "Chiral spin liquid and quantum criticality in extended $S = \frac{1}{2}$ Heisenberg models on the triangular lattice". In: *Phys. Rev. B* 95, 035141 (2017). DOI: 10.1103/PhysRevB.95.035141.

[10] P. Nataf, M. Lajkó, A. **Wietek**, K. Penc, F. Mila, and A. M. Läuchli. "Chiral Spin Liquids in Triangular-Lattice SU(N) Fermionic Mott Insulators with Artificial Gauge Fields". In: *Phys. Rev. Lett.* 117, 167202 (2016). DOI: 10.1103/PhysRevLett.117.167202.

[11] J. Wassermann, A. **Wietek**, C. Hadziioannou, and H. Igel. "Toward a Single-Station Approach for Microzonation: Using Vertical Rotation Rate to Estimate Love-Wave Dispersion Curves and Direction Finding". In: *Bulletin of the Seismological Society of America* 106(3):1316 (2016). DOI: 10.1785/0120150250.

[12] A. **Wietek**, A. Sterdyniak, and A. M. Läuchli. "Nature of chiral spin liquids on the kagome lattice". In: *Phys. Rev. B* 92, 125122 (2015). DOI: 10.1103/PhysRevB.92.125122.