

Jeff Maki
Postdoctoral Researcher at the Pitaevskii BEC Center, INO-CNR, Trento, Italy
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[Google Scholar](#)
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Personal Profile:

Theoretical physicist interested in the non-equilibrium dynamics of quantum many-body systems. My work often involves both perturbative and non-perturbative analytical methods, as well as numerical simulations using Python, Mathematica, Matlab, etc.

Education:

2013-2019 Ph.D. in Physics, University of British Columbia
Supervisor: Prof. F. Zhou.
Thesis: *Scale Symmetry and the Non-Equilibrium Quantum Dynamics of Ultra-Cold Atomic Gases*

2011-2013 B.Sc. with distinction Physics, University of Calgary

2010-2011 M.A. in Greek and Roman Studies, University of Calgary (incomplete)

2006-2010 B.A. Honours first class Greek and Roman Studies, University of Calgary

Appointments:

Sept. 2022 - Present *Postdoctoral Researcher, INO-CNR Pitaevskii BEC Center*
Supervisors: A. Biella and Prof. S. Stringari.
Projects: Non-equilibrium physics of open quantum systems. The role of disorder on superfluidity.

Nov. 2021-Jan. 2022 Visiting researcher, University of Heidelberg
Supervisor: Prof. T. Enss.
Project: *Transport of p-wave Fermi gases*

Jul. 2019-Jun. 2022 Postdoctoral Researcher, University of Hong Kong
Supervisor: Prof. S. Zhang.
Project: *Study of transport with finite ranged interactions*

Research Interests:

- Non-equilibrium many-body dynamics
- Dynamical symmetries
- Thermodynamic transport and many-body physics
- Quantum field theory and its applications to dynamics

Research Experience:

Postdoctoral study

Sept. 2022 - present Non-equilibrium dynamics of open quantum systems:

- Examine dynamics of quantum Ising model coupled to environment
- Use of tensor networks, time-dependent DMRG and quantum trajectories
- Role of environment in false vacuum decay

The role of disorder in superfluid BECs:

- How disorder affects speed of sound
- Testing violations of Leggett's bound on superfluid fraction

Nov. 2021-Jun. 2022 Transport of p-wave Fermi gases:

- Examining thermal conductivity of p-wave Fermi gas
- Analytical virial expansion
- Luttinger Liquid physics
- Numerical solution to the Boltzmann equation

Jul. 2019-Jul. 2022 Study of transport with finite ranged interactions with a focus on p-wave Fermi gases:

- Investigating transport properties of quantum gases with finite ranged interactions
- Use of virial expansion, quantum field theory and hydrodynamics
- Simulating hydrodynamic equations of motion
- Experimental investigation on energetics of low-dimensional p-wave gases

Ph. D. study

2013-2019 Scale Symmetry and the Non-Equilibrium Quantum Dynamics of Ultra-Cold Atomic Gases:

- Analytical symmetry analysis in non-relativistic quantum mechanics
- Non-perturbative techniques in quantum mechanics
- Numerical simulation of hydrodynamics

Awards:

All values are in Canadian dollars.

Physics

2015	NSERC PGSD Award (four-year fellowship): \$21,000 per year
2014	Faculty of Science Graduate Award: \$3,000
2013	Department of Physics and Astronomy Quantum Mechanics Prize: \$2,600
2013	Physics and Astronomy Graduate Scholarship: \$1,400
2013	Faculty of Science Graduate Award: \$2,000
2013	Undergraduate Physics Research Prize: \$250
2013	Department of Physics and Astronomy Venkatesan Silver Medallion: \$1000
2013	NSERC Undergraduate Student Research Award: \$6,000
2013	Nano-USRA at the University of Alberta: \$2,800
	- Polarons in Low Dimensional Systems with Dr. Frank Marsiglio
2012	O. George Fritz Scholarship: \$900
2012	Louise McKinney Scholarship: \$2,500
2012	NSERC Undergraduate Student Research Award: \$6,000 (declined)
2012	Pure 2012 Undergraduate Research Award: \$6,000
	- Cavity QED and the van der Waals Force with Dr. David Feder

Greek and Roman Studies

2011	SSHRC Joseph-Armand Bombardier Canada Graduate Scholarship: \$17,500 (declined)
2010	Silver Medal in Greek and Roman Studies
2010	Queen Elizabeth II Scholarship: \$10,000
2010	Luke Bridgewater Memorial Scholarship: \$5,000
2009	Jason Lang scholarship: \$1,500
2009	Jason Lang scholarship: \$1,500

Publications:

I currently have 11 first author publications, 13 publications in total, and 3 papers on the arXiv.

1. Emergent s-wave interactions between identical fermions in quasi-one-dimensional geometries: Kenneth G. Jackson, Colin J. Dale, **Jeff Maki**, Kevin G. S. Xie, Ben A. Olsen, Denise J. M. Ahmed-Braun, Shizhong Zhang and Joseph H. Thywissen: *Phys. Rev. X* **13**, 021013 (2023).
2. Transport in p-wave-interacting Fermi gases. **Jeff Maki** and Tilman Enss: *Phys. Rev. A* **107**, 023317 (2023).
3. Viscous flow in a one-dimensional spin-polarized Fermi gas: The role of integrability on viscosity. **Jeff Maki** and Shizhong Zhang: *Phys. Rev. A* **107**, 013310 (2023).
4. Dynamics of Strongly Interacting Fermi Gases with Time-Dependent Interactions: Consequences of Conformal Symmetry. **Jeff Maki**, Shizhong Zhang, and Fei Zhou: *Phys. Rev. Lett.* **128**, 040401 (2022).
5. Thermodynamic Contacts and Breathing Mode physics of 1D p-wave Fermi Gases in the High Temperature Limit. **Jeff Maki**: *Phys. Rev. A* **104**, 063314 (2021).
6. The Role of the Effective Range in Resonantly Interacting Fermi Gases: How Breaking Scale Symmetry Affects the

- Bulk Viscosity. **Jeff Maki** and Shizhong Zhang: *Phys. Rev. Lett.* **125**, 240402 (2020).
7. Far-Away-From-Equilibrium Quantum Critical Conformal Dynamics: Reversibility, Thermalization, and Hydrodynamics. **Jeff Maki** and Fei Zhou: *Phys. Rev. A* **102**, 063319 (2020).
 8. Virial Expansion for a Three-Component Fermi Gas in One Dimension: The Quantum Anomaly Correspondence. **Jeff Maki** and Carlos R. Ordóñez: *Phys. Rev. A* **100**, 063604 (2019).
 9. Quantum Many-Body Conformal Dynamics: Symmetries, Geometry, Conformal Tower States, and Entropy Production. **Jeff Maki** and Fei Zhou: *Phys. Rev. A* **100**, 023601 (2019).
 10. Nonperturbative Dynamical Effects in Nearly-Scale Invariant Systems: The action of Breaking Scale Invariance. **Jeff Maki**, Li-Ming Zhao and Fei Zhou: *Phys. Rev. A* **98**, 013602 (2018).
 11. Scale Invariant Dynamics and Universal Quantum Beats in Bose Gases. **Jeff Maki**, Shao-Jian Jiang and Fei Zhou: *Euro. Phys. Letts.* **118**, 5 (2016).
 12. Extremely Long-Lived Universal Resonant Bose Gas. Shao-Jian Jiang, **Jeff Maki** and Fei Zhou: *Phys. Rev. A* **93**, 043605 (2016).
 13. Quantum N-Boson States and Quantized Motion of Solitonic Droplets. **Jeff Maki**, Mohammadreza Mohammadi and Fei Zhou: *Phys. Rev. A* **90**, 063609 (2014).

Unpublished Works and Works in Preparation:

14. Monte Carlo matrix-product-state approach to the false vacuum decay in the monitored quantum Ising chain. **Jeff Maki**, Anna Berti, Iacopo Carusotto, and A. Biella: submitted to arXiv.
15. Emergent Infrared Conformal Dynamics in Strongly Interacting Quantum Gases. **Jeff Maki**, and Fei Zhou: <https://arxiv.org/abs/2305.19061>
16. Universal Scaling Properties of Cold Atom Scattering Dynamics in Confined Low Dimensional Geometries. **Jeff Maki** and Fei Zhou: <https://arxiv.org/abs/1505.01517>

Talks and Conferences:

Bold dates are invited talks

Mar. 2023	Les Houches: Out-of-equilibrium physics with photons and atoms	- Poster: False vacuum decay in the continuously monitored quantum Ising model
Nov. 2022	University of Heidelberg	- Seminar: p-Wave Fermi Gases in confined Geometries
Mar. 2022	Univeristy of Trento	- Seminar: p-Wave Fermi Gases in Confined Geometries
Nov. 2021	University of Heidelberg	- Seminar: Conformal Symmetry and the Dynamics of the Unitary Fermi Gas
June 2021	APS DAMOP	- Presentation: Transport in the presence of an effective range: comparing shear and bulk viscosities - Presentation: Conformal symmetry and time-dependent interactions in the dynamics of unitary Fermi gases
June 2020	APS DAMOP	- Poster: Bulk Viscosity and the Virial Expansion for a Three-Component Fermi Gas in One Dimension -Presentation: Breaking Scale Invariance: The role of the effective range on the bulk viscosity in s- and p-wave gases
Oct. 2019	Kyoto-Beijing-Tokyo Workshop on Ultracold Atomic Gases	-Presentation: The role of the effective Range on the transport dynamics of Fermi gases
Apr. 2019	CIFAR Quantum Materials Annual Meeting	-Poster: Quantum Many-Body Conformal Dynamics: Symmetries, Geometry, Conformal Tower States, and Entropy Production.
Jun. 2018	APS DAMOP	-Presentation: Non-Perturbative Dynamical Effects in Nearly Scale Invariant Systems
May 2018	University of British Columbia	-Seminar: Non-Perturbative Dynamical Effects in Nearly Scale Invariant Systems
Jun. 2017	APS DAMOP	-Poster: Non-Perturbative Dynamical Effects in Nearly Scale Invariant Systems
Apr. 2017	CIFAR Quantum Materials Annual Meeting	-Poster: Quantum Dynamics for Nearly Scale Invariant Systems

Jun. 2016	Institute of Physics, Chinese Academy of Sciences	-Seminar: Scale Invariant Quantum Dynamics and Universal Quantum Beats in Bose Gases
Jun. 2016	APS DAMOP	-Presentation: The role of Scale Invariance on Far-From-Equilibrium Dynamics in 2D Bose Gases
Apr. 2015	CIFAR Quantum Materials Annual Meeting	-Poster: Universal Scattering in Confined Low Dimensional Geometries
Jun. 2014	APS DAMOP	-Presentation: N-Body Bound States in Low Dimensional Systems
Apr. 2014	CIFAR Quantum Materials Annual Meeting	-Poster: N-Body Bound States in Low Dimensional Systems
Oct. 2012	Canadian Undergraduate Physics Conference	-Presentation: d-dimensional van der Waals Forces

Teaching Experience:

- University of British Columbia (UBC). Teachers' assistant, 2015-2018
 - Phys 107, Introductory physics for physics majors
 - Led tutorials, answered student emails, marking, made tutorials, helped instructor with demonstrations, led small discussions during class times via socratic questions, helped create problem sets for tutorials
- UBC. Teachers' assistant, 2013-2014
 - Phys 101 and 102, Introductory physics for non-physics majors
 - Led tutorials, led first year experiments, marking
- University of Calgary. Teachers' assistant, 2010-2011
 - Greek and Roman Studies 209, Greek and Roman Mythology
 - Led tutorials and discussions, Socratic questioning about reading materials, grading essays

Engagement:

- Member and Head of Graduate Student Interview Committee (GSIC)
 - Helped design interview policies for interviewing potential physics department hires
 - Conducted interviews, leading discussions with other interviewees, summarizing results and communicating said results to the department

About me:

- Citizenship: Canada and United States
- Language: English, Latin, ancient Greek, German (beginner), Cantonese (beginner)
- Hobbies: Reading ancient Greek and Latin, Archery and Kyudo, baking