

Yangqian Yan

Curriculum Vitae

G9, Science Center North Block
Chinese University of Hong Kong
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Professional Experience

- Aug 2021–
–present **Assistant Professor**, *Department of Physics*,
Chinese University of Hong Kong, Shatin NT, Hong Kong SAR
- Jul 2017–
–Jul 2021 **Postdoctoral Research Associate**, *Department of Physics and Astronomy*,
Purdue University, West Lafayette, IN, USA
Supervisor: Qi Zhou, Department of Physics and Astronomy
- Jun 2016–
–Jun 2017 **Postdoctoral Scholar**, *Department of Physics*,
Indiana University-Purdue University Indianapolis, Indianapolis, IN USA
Supervisor: Tony E. Lee, Department of Physics

Education

- Aug 2010–
–May 2016 **PhD, Physics**, *Washington State University*, Pullman, WA
Thesis title: Path integral Monte Carlo studies of ultracold few-atom systems
Advisers: Prof. Doerte Blume; GPA: 4.0/4.0
- Sep 2006–
–Jun 2010 **BA, Physics**, *University of Science and Technology of China*, Hefei, China
Special Class for the Gifted Young

Teaching Experience

- Semester II
2024 **PHY3061 Computational Physics I**, *Chinese University of Hong Kong*
Undergraduates, Introduction to Computer Simulations of Physical Systems
- Semester I
2021-2023 **PHY3041 Electromagnetic Theory I**, *Chinese University of Hong Kong*,
Undergraduate Core Course, Introduction to Electrodynamics by David J. Griffiths
- Spring 2020 **Visiting Teaching Scholar**, *Tecumseh Junior High school*
Designed and taught a course on temperature conversion for 8-th grade students
- Oct 2019–
–Nov 2019 **Temporary Instructor for 3 Sessions**, *Purdue University*
PHYS630 Electricity and Magnetism I, Instructor: Prof. Chris Greene
- Aug 2010–
–May 2012 **Teaching Assistant**, *Washington State University*, Pullman, WA
ASTR135 Descriptive Astronomy Lab, PHYS101 General Physics Lab

Research Interests

- Atom**, Bose-Einstein Condensation, Degenerate Fermi gases, Optical Lattices, Few-Body
Molecule, Physics, Unitary Bose/Fermi gases, Efimov Physics, Cluster Expansion/Virial Coefficients,
Optics Synthetic Dimension, Tan Contact, SU(N) Fermions, Non-Equilibrium Dynamics
Condensed Matter Floquet Theory, SU(N) Fermions, Strongly Correlated Systems, Topological Insulator,
Synthetic Gauge Field, Chern Number, Path Integral Monte Carlo Simulation

Research Grants

- PI **Early Career Scheme 24308323**, *Research Grants Council (RGC)*,
2023-09-01 to 2026-08-31, HKD 754,378
Topological states of matter in ultracold atoms: probing the interplay of topology and interaction using dynamics
- PI **Young Scientist Fund 392242746**, *National Natural Science Foundation of China*,
2023-01-01 to 2025-12-31, CNY 300,000.00
Equation of state and thermodynamic properties of the unitary Fermi gas
- Co-PI **Collaborative Research Fund C4050-23GF**, *Research Grants Council (RGC)*,
2024-06-30 to 2027-06-29, HKD 8,909,555 (individual share HKD 889,707)
Investigating long-range many-body physics with ultracold dipolar gases in optical lattices
- PI, **Direct Grant 476266630**, *The Chinese University of Hong Kong*,
Internal 2024-05-1 to 2025-04-30, HKD 8,903
Topological states of matter in ultracold atoms: probing the interplay of topology and interaction using dynamics
- PI, **Direct Grant 354553061**, *The Chinese University of Hong Kong*,
Internal 2023-03-01 to 2024-02-29, HKD 32,084
Finite-temperature Tan contact of degenerate Fermi gases
- PI, **Direct Grant 178907241**, *The Chinese University of Hong Kong*,
Internal 2022-06-30 to 2023-06-29, HKD 150,000
Finite-temperature effect in ultracold atomic quantum simulators

Teaching Grants

- PI, **Funding Scheme for Engaging Postgraduate Students in Teaching and Teaching Development**, *The Chinese University of Hong Kong, UGC*,
CUHK 2023-10 to 2024-10, HKD 300,000
Interactive Notebooks for Undergraduates: Developed by Postgraduate Students
- PI, **The Roadmap of Virtual Teaching and Learning Development**, *Faculty of Science, CUHK*,
FoS 2022-11 to 2023-03, HKD 20,000
A searchable course website with micro- modules and cross reference

Community Service











- Grant Reviewer Faculty Development Scheme, Research Grants Council, Hong Kong
- 2023– **Honorary Secretary**, *Executive Committee*, the Physical Society of Hong Kong
Maintain website, Handle membership application, Call for Executive Committee Meetings, etc.
- July 2024 **Conference Secretary**, *Co-chair of Scientific Committee*, 2024 Joint Annual Conference of Physical Societies in Guangdong-Hong Kong-Macao Greater Bay Area, July 30 - August 1, 2024
- Referee Activities 100+ times for APS, IOP and Nature, including Nature, Phys. Rev. Lett., Phys. Rev. Research, Phys. Rev. A, Phys. Rev. B, J. Phys. A, J. Phys. B, J. Phys. C, J. Phys. Comm., Machine Learning: Science and Technology, Phys. Lett. A, Physica Scripta.

Manuscripts

- arXiv **Xin-Yuan Gao, D. Blume, and Yangqian Yan**, *Exact thermodynamics for weakly interacting normal-phase quantum gases: Equations of state for all partial waves*, Submitted to Physical Review Letters
📄 arXiv:2405.10291
- arXiv **Hei Lam and Yangqian Yan**, *Interaction induced splitting of Dirac monopoles in the topological Thouless pumping of strongly interacting Bosons and $SU(N)$ Fermions*
📄 arXiv:2405.17183

Publications

- [1] X.-Y. Gao, D. Blume, and **Y. Yan**. Temperature-Dependent Contact of Weakly Interacting Single-Component Fermi Gases and Loss Rate of Degenerate Polar Molecules. *Phys. Rev. Lett.*, 131(04) 043401, 2023. 📄 doi:10.1103/PhysRevLett.131.043401.
- [2] F. Jia, Z. Huang, L. Qiu, R. Zhou, **Y. Yan**, and D. Wang. Expansion Dynamics of a Shell-Shaped Bose-Einstein Condensate. *Phys. Rev. Lett.*, 129(24) 243402, December 2022. 📄 doi:10.1103/PhysRevLett.129.243402.
- [3] T. Dornheim and **Y. Yan**. Abnormal Quantum Moment of Inertia and Structural Properties of Electrons in 2D and 3D Quantum Dots: An Ab Initio Path-Integral Monte Carlo Study. *New J. Phys.*, 24(11) 113024, November 2022. 📄 doi:10.1088/1367-2630/ac9f29.
- [4] C.-H. Li, **Y. Yan**, S.-W. Feng, S. Choudhury, D. B. Blasing, Q. Zhou, and Y. P. Chen. Bose-Einstein Condensate on a Synthetic Topological Hall Cylinder. *PRX Quantum*, 3(1) 010316, January 2022. 📄 doi:10.1103/PRXQuantum.3.010316.
- [5] R. Zhang, C. Lv, **Y. Yan**, and Q. Zhou. Efimov-like States and Quantum Funneling Effects on Synthetic Hyperbolic Surfaces. *Science Bulletin*, 66(19) 1967–1972, October 2021. 📄 doi:10.1016/j.scib.2021.06.017.
- [6] R. Zhang, **Y. Yan**, and Q. Zhou. Localization on a Synthetic Hall Cylinder. *Phys. Rev. Lett.*, 126(19) 193001, May 2021. 📄 doi:10.1103/PhysRevLett.126.193001.
- [7] B. Song, **Y. Yan**, C. He, Z. Ren, Q. Zhou, and G.-B. Jo. Evidence for Bosonization in a Three-Dimensional Gas of $SU(N)$ Fermions. *Phys. Rev. X*, 10(4) 041053, December 2020. 📄 doi:10.1103/PhysRevX.10.041053.
- [8] C. Lyu, S. Choudhury, C. Lv, **Y. Yan**, and Q. Zhou. Eternal Discrete Time Crystal Beating the Heisenberg Limit. *Phys. Rev. Research*, 2(3) 033070, July 2020. 📄 doi:10.1103/PhysRevResearch.2.033070.
- [9] **Y. Yan**, S.-L. Zhang, S. Choudhury, and Q. Zhou. Emergent Periodic and Quasiperiodic Lattices on Surfaces of Synthetic Hall Tori and Synthetic Hall Cylinders. *Phys. Rev. Lett.*, 123(26) 260405, December 2019. 📄 doi:10.1103/PhysRevLett.123.260405.
- [10] D. B. Blasing, J. Pérez-Ríos, **Y. Yan**, S. Dutta, C.-H. Li, Q. Zhou, and Y. P. Chen. Observation of Quantum Interference and Coherent Control in a Photochemical Reaction. *Phys. Rev. Lett.*, 121(7) 073202, August 2018. 📄 doi:10.1103/PhysRevLett.121.073202.
- [11] **Y. Yan** and Q. Zhou. Yang Monopoles and Emergent Three-Dimensional Topological Defects in Interacting Bosons. *Phys. Rev. Lett.*, 120(23) 235302, June 2018. 📄 doi:10.1103/PhysRevLett.120.235302.

- [12] **Y. Yan** and D. Blume. Path Integral Monte Carlo Ground State Approach: Formalism, Implementation, and Applications. *J. Phys. B*, 50(22) 223001, November 2017.  doi:10.1088/1361-6455/aa8d7f.
- [13] X. Y. Yin, **Y. Yan**, and D. H. Smith. Dynamics of Small Trapped One-Dimensional Fermi Gas under Oscillating Magnetic Fields. *Phys. Rev. A*, 94(4) 043639, October 2016.  doi:10.1103/PhysRevA.94.043639.
- [14] **Y. Yan** and D. Blume. Path-Integral Monte Carlo Determination of the Fourth-Order Virial Coefficient for a Unitary Two-Component Fermi Gas with Zero-Range Interactions. *Phys. Rev. Lett.*, 116(23) 230401, June 2016.  doi:10.1103/PhysRevLett.116.230401.
- [15] **Y. Yan** and D. Blume. Energy and Structural Properties of N-boson Clusters Attached to Three-Body Efimov States: Two-body Zero-Range Interactions and the Role of the Three-Body Regulator. *Phys. Rev. A*, 92(3) 033626, September 2015.  doi:10.1103/PhysRevA.92.033626.
- [16] **Y. Yan** and D. Blume. Incorporating Exact Two-Body Propagators for Zero-Range Interactions into N-body Monte Carlo Simulations. *Phys. Rev. A*, 91(4) 043607, April 2015.  doi:10.1103/PhysRevA.91.043607.
- [17] S. E. Gharashi, X. Y. Yin, **Y. Yan**, and D. Blume. One-Dimensional Fermi Gas with a Single Impurity in a Harmonic Trap: Perturbative Description of the Upper Branch. *Phys. Rev. A*, 91(1) 013620, January 2015.  doi:10.1103/PhysRevA.91.013620.
- [18] D. Blume and **Y. Yan**. Generalized Efimov Scenario for Heavy-Light Mixtures. *Phys. Rev. Lett.*, 113(21) 213201, November 2014.  doi:10.1103/PhysRevLett.113.213201.
- [19] **Y. Yan** and D. Blume. Temperature Dependence of Small Harmonically Trapped Atom Systems with Bose, Fermi, and Boltzmann Statistics. *Phys. Rev. A*, 90(1) 013620, July 2014.  doi:10.1103/PhysRevA.90.013620.
- [20] **Y. Yan** and D. Blume. Abnormal Superfluid Fraction of Harmonically Trapped Few-Fermion Systems. *Phys. Rev. Lett.*, 112(23) 235301, June 2014.  doi:10.1103/PhysRevLett.112.235301.
- [21] **Y. Yan** and D. Blume. Harmonically Trapped Fermi Gas: Temperature Dependence of the Tan Contact. *Phys. Rev. A*, 88(2) 023616, August 2013.  doi:10.1103/PhysRevA.88.023616.

Selected Invited Talks at Conferences

- Oct 2024 **Okinawa School in Physics 2024: Coherent Quantum Dynamics**, *Okinawa Institute of Science and Technology Graduate University, Japan*
3 lectures on quantum gases with two-body loss (90 minutes each)
- Dec 2023 **HKUST-USTC joint workshop on quantum science**, *HKUST Jockey Club Institute for Advanced Study, HK*
Two-body p-wave loss of ultracold fermionic molecules
- Nov 2023 **HKUST-U of Strathclyde Joint Workshop on Quantum Technologies**, *HKUST Jockey Club Institute for Advanced Study, HK*
Cold Atoms and Molecules as Quantum Simulators
- Aug 2023 **Workshop on Cold Atom Physics and Quantum Information for Young Researchers**, *Zhenzhou, China*
Finite-temperature p-wave contact and loss rate of Femi gases

- July 2023 **Joint Annual Conference of Physical Societies in Guangdong-Hong Kong-Macao Greater Bay Area**, *City University of Hong Kong*
Finite-temperature p -wave contact and loss rate of trapped Fermi gases
- Jun 2023 **Optical Tweezer Mini Workshop**, *Center for Quantum Research and Technology The University of Oklahoma, USA*
Finite-temperature p -wave contact and loss rate of trapped Fermi gases
- Dec 2022 **Advances in Cold Atom Physics and Its Interdisciplinary Frontiers**, *Xi'an Jiaotong University, China*
Thermodynamics of ultracold interacting Fermi gases
- Jun 2020 **51th APS DAMOP**, *Virtual, originally planned at Portland, USA*
🌀 Spinor BECs: from topological defects to synthetic Hall cylinders
- Nov 2017 **2017 Midwestern Cold Atom Workshop**, *University of Michigan, Ann Arbor, Michigan, USA*
🌀 Interaction effects on Dirac and Yang monopoles in a Bose-Einstein condensate
- Apr 2014 **Institute for Nuclear Theory Program INT-14-1**, *University of Washington, Seattle, WA*, 🌀 Universality in few-body systems: Theoretical challenges and new directions
🌀 Harmonically trapped unitary few-body systems at finite temperature.

Selected Invited Talk at Universities

- April 2024 **Seminar**, *Sun Yat Sen University*
Dynamics of quantum gases with two-body losses
- Oct 2023 **Seminar**, *Institute of Physics Chinese Academy of Sciences*
Finite-temperature p -wave contact and loss rate of Fermi gases
- July 2023 **Seminar**, *Shanxi University*
Finite-temperature p -wave contact and loss rate of Fermi gases
- June 2023 **Colloquium**, *Washington State University*
Finite-temperature p -wave contact and loss rate of trapped Fermi gases
- Dec 2022 **Colloquium**, *University of Hong Kong*
Quantum simulation of strongly interacting Fermi gases and topological states of matter using ultracold atoms
- Mar 2022 **Virtual Colloquium**, *University of Oklahoma*
Bridging Few- And Many-Body Physics in Fermi Gases
- Feb 2021 **Virtual Seminar**, *Chinese University of Hong Kong*
Bridging Few- And Many-Body Physics in Fermi Gases
- Feb 2021 **Virtual Colloquium**, *Chinese University of Hong Kong*
Synthetic Topological States of Matter in Atomic, Molecular, and Optical Physics
- Jan 2021 **Virtual Colloquium**, *University of Science and Technology of China*
Bridging Few- And Many-Body Physics in Fermi Gases
- Dec 2020 **Virtual Colloquium**, *Renmin University of China*
Virial expansion and Contact
- Jan 2020 **Colloquium**, *California State University, Fullerton, CA, USA*
Ultracold Atomic Gases: From Universal Physics to Quantum Simulations.
- Jan 2020 **AMO Journal Club**, *Purdue University, West Lafayette, IN*
Ultracold Atomic Gases: From Universal Physics to Quantum Simulations.

- Sep 2017 **AMO Journal Club**, *Purdue University*, West Lafayette, IN
Interaction effects on Dirac and Yang monopoles in a Bose-Einstein condensate.
- Oct 2017 **Seminar**, *Sun Yet-sun University*, Zhuhai, China
Interaction effects on Dirac and Yang monopoles in a Bose-Einstein condensate.
- Sep 2017 **Seminar**, *Shanghai University*, Shanghai, China
Interaction effects on Dirac and Yang monopoles in a Bose-Einstein condensate.
- Sep 2017 **Seminar**, *Shanghai University*, Shanghai, China
Tunable Floquet-Bloch bands in optical lattices with amplitude modulation and periodic shaking.
- Sep 2016 **Seminar**, *Indiana University-Purdue University Indianapolis*, IN, USA
Path integral Monte Carlo for Fermi gases.