Yaqi Hou

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Department of Physics and Astronomy
University of North Carolina - Chapel Hill

Education

University of North Carolina at Chapel Hill, Chapel Hill, NC — Aug 2016 - May 2022
Ph.D. candidate in Physics

Duke University, Durham, NC — Aug 2013 - Jul 2014
Visiting student in Physics

Shandong University - Taishan College, Jinan, Shandong, China — Sep 2011 - Jun 2015
B.S. in Physics

Fellowships and Awards

UNC Dissertation Completion Fellowship — Aug 2021 - May 2022
Support tuition, fees and stipends during the final PhD year for completing the dissertation

UNC Dean's Graduate Fellowship in the College of Arts & Sciences — May 2021
Support summer fees, stipends and travel funds

Research Experience

Quantum virial expansion of unitary quantum matter — Aug 2019 - Present
- Develop a novel and analytical method to automate algebraic operation to evaluate the Quantum Virial Expansion
- Implement codes and optimize performance for large-scale parallel deployment on Open Science Grid
- Apply across multiple systems: homogeneous and harmonically trapped Unitary Fermi Gas, dilute neutron matter
- Generalize to different observables: thermodynamics, Tan's contact, momentum distribution, structure factor and etc.

Energy of bosonic droplets from quantum noise — Jul 2018 - May 2019
- Extracted ground-state energy of N-body Boson droplets from quantum noise using the cumulant expansion

Stochastic methods for thermaldynamics of quantum matter at finite temperature — May 2017 - Dec 2018
- Applied hybrid Quantum Monte Carlo (QMC) and Complex Langevin (CL) to extract thermodynamics for SU(N) Fermi gas
- Introduced higher-order symplectic integrators to reduce decomposition errors
- Investigated the improvements on sampling efficiencies of auxiliary fields

Numerical simulation of acoustic field propagation — Mar 2015 - Jun 2015
- Simulated acoustic field propagation using Finite Difference Time Domain (FDTD) method and spectrum method

Flow of granular material in 2D hopper — Sep 2013 - May 2014
- Performed image registration, boundary detection to identify and analysis granular particle flow.
- Reconstructed the stress information from image intensities to study jamming-flowing phase transition

Teaching Experience

Graduate Teaching Assistant — Jun 2016 - May 2020
- PHYS 114 General Physics for non-physics major, led workshop as *Teaching Assistant*
- PHYS 118 General Physics for physics major, led workshop as *Teaching Assistant*
- PHYS 331 Introductory numerical techniques in physcis, led lab session as *Teaching Assistant*
- PHYS 741 PhD qualification exam recitation - statistical physics, led recitation session as *Instructor*

Publications

8. Fourth- and fifth-order virial expansion of harmonically trapped fermions at unitarity
   Y. Hou, K. J. Morrell, A. J. Czejdo and J. E. Drut, Phys. Rev. Research **3**, 033099 (2021)
7. Pairing and the spin susceptibility of the polarized unitary Fermi gas in the normal phase
   L. Rammelmüller, **Y. Hou**, J. E. Drut and J. Braun, Phys. Rev. A **103**, 043330 (2021)
6. Fourth- and Fifth-Order Virial Coefficients from Weak Coupling to Unitarity
   Y. Hou and J. E. Drut, Phys. Rev. Lett. **125**, 050403 (2020)
   Selected as Editor's suggestion
5. Virial expansion of attractively interacting Fermi gases in one, two, and three dimensions, up to fifth order
   Y. Hou and J. E. Drut, Phys. Rev. A **102**, 033319 (2020)
4. Virial coefficients of trapped and un-trapped three-component fermions with three-body forces in arbitrary spatial dimensions
   A. J. Czejdo, J. E. Drut, **Y. Hou**, J. R. McKenney and K. J. Morrell, Phys. Rev. A **101**, 063630 (2019)

3. Leading-and next-to-leading-order semiclassical approximation to the first seven virial coefficients of spin-1/2 fermions across spatial dimensions
   Y. Hou, A. J. Czejdo, J. DeChant, C. R. Shill and J. E. Drut, Phys. Rev. A **100**, 063627 (2019)
2. TEST_POSITIVE at W-NUT 2020 Shared Task-3: Joint Event Multi-task Learning for Slot Filling in Noisy Text
   C. Chen, C. Y. Huang, **Y. Hou**, Y. Shi, E. Dai and J. Wang. In Proceedings of the Sixth Workshop on Noisy User-generated Text (W-NUT) at EMNLP (2020)
1. Thermal conductivity and thermoelectric performance of $Sr_xBa_{1-x}Nb_2O_6$ ceramics at high temperatures
   Y. Li, J. Liu, **Y. Hou**, Y. Zhang, Y. Zhou, W. Su, Y. Zhu, J. Li and C. Wang, Scr. Mater. **109**, 80-83 (2015).

Presentations

3. From few to many: thermodynamics with up to seventh-order virial coefficients
   Y. Hou and J. E. Drut, APS April Meeting 2021 S13.00007
2. Fourth- and Fifth-Order Virial Coefficients from Weak Coupling to Unitarity
   Y. Hou and J. E. Drut, APS March Meeting 2021 M21.00006
1. Fourth- and Fifth-Order Virial Coefficients from Weak Coupling to Unitarity
   Y. Hou and J. E. Drut, Southeastern Section of the APS (SESAPS) 2020 F05.00002

Academic services

Assistant organizing Quantum Many-Body Days 2021 Sep 2021
Reference: Prof. Joaquin E. Drut, UNC - Chapel Hill

- Co-hosted and managed the zoom webinars and live stream on YouTube;
- Seminar detail: `https://tarheels.live/rpmbt21/schedule/`

COMAP MCM/ICM Contest Judge Feb 2021 - Apr 2021
Reference: Dr. Luke Castle, North Carolina State University

- Evaluate and comment submissions for a inter-disciplinary problem on mathematical modeling and policy making

Co-mentor for Graduate Research Dec 2019 - Aug 2021
Reference: Prof. Joaquin E. Drut, UNC - Chapel Hill

- Helped two graduate students (Aleks Czejdo and Kaitlyn Morrell) with research projects
- Assisted in managing group's computational resources and coordinated its usage

Co-mentor for Undergraduate Research May 2020 - Aug 2020
Reference: Prof. Joaquin E. Drut, UNC - Chapel Hill

- Co-mentored undergraduates (Kean Leung and Austin Blitstein) for Undergraduate Summer Research program
- Coordinated team's research plan; helped the student to participate in research work

Technical skills

Programming Languages: Python, Fortran, MatLab, C, Lua, Emacs-Lisp, Julia
Frameworks and Libraries: Numpy, pyTorch, Matplotlib, Scipy, Cython, pyQt, pandas, sqlite, OpenMP, MPI
Supporting Skills: Linux, Emacs, Git, LaTeX, Jupyter, HTcondor, Excel, PowerPoint