

Princeton Center for Theoretical Science

The Princeton Center for Theoretical Science is dedicated to exploring the frontiers of theory in the natural sciences. Its purpose is to promote interaction among theorists and seed new directions in research, especially in areas cutting across traditional disciplinary boundaries.

The Center is home to a corps of Center Postdoctoral Fellows, chosen from nominations made by senior theoretical scientists around the world. A group of senior Faculty Fellows, chosen from science and engineering departments across the campus, are responsible for guiding the Center. Center activities include focused topical programs chosen from proposals by Princeton faculty across the natural sciences. The Center is located on the fourth floor of Jadwin Hall, in the heart of the campus “science neighborhood”. The Center hopes to become the focus for innovation and cross-fertilization in theoretical natural science at Princeton.

Faculty Fellows

Igor Klebanov, Director
Ned Wingreen, Associate Director
Jeremy Goodman
Duncan Haldane
Andrej Košmrlj
Mariangela Lisanti
Frans Pretorius
Silviu Pufu
Eliot Quataret
Shinsei Ryu

Center Postdoctoral Fellows

Vir Bulchandani 2020-2023	Minjae Cho 2021-2024
Giorgio Cipolloni 2021-2024	Scott Collier 2020-2023
Trevor GrandPre 2022-2024	David Hosking 2022-2025
Brooke Husic 2020-2023	Jonah Kudler-Flam 2022-2025
Yves Kwan 2022-2025	Alejandro Martinez-Calvo 2021-2024
Elias Most 2020-2023	Anirudh Prabhu 2022-2025
Carolyn Raithel 2020-2023	Rhine Samajdar 2022-2025
Frank Schindler 2020-2023	Nicole Shibley 2021-2024

To find out more about Center Postdoctoral Fellowships and Programs see: <https://pcts.princeton.edu>



Many-body Physics with Synthetic Quantum Systems

April 12-14, 2023

Organizers

Waseem Bakr
Sarang Gopalakrishnan
David Huse
Rhine Samajdar
Jeff Thompson
Lawrence Cheuk

Sponsored in part by the Princeton Quantum Initiative

Many-body Physics with Synthetic Quantum Systems

Wednesday, April 12, 2023

8:30-8:55 am Check in and Light Breakfast

Session 1 (Chair: Sarang Gopalakrishnan)

- 9:00-9:10 Opening Remarks
- 9:10-9:45 Observing the effects of many measurements without post selection
Ehud Altman (Berkeley)
- 9:45-10:20 Decoding and steering Monitored Dynamics
Matthew Fisher (UCSB)

10:20-11:00 Coffee Break

- 11:00-11:35 Error mitigation thresholds in noisy quantum circuits
Michael Gullans (Maryland)
- 11:35-12:10 Gauge dualities for (good) LDPC codes and connections to local testability
Vedika Khemani (Stanford)

12:10-2:00 Lunch Break

Session 2 (Chair: Jeff Thompson)

- 2:00 - 2:35 Exploring new scientific frontiers with programmable quantum systems
Misha Lukin (Harvard)
- 2:35-3:10 Bethe phantom states in spin chains, and dipolar bilayers
Wolfgang Ketterle (MIT)

3:10-4:00 Coffee Break

- 4:00-4:35 Thermalization of large bosonic quantum many-body systems under the microscope
Monika Aidelsburger (LMU)
- 4:35-5:10 Quantum simulation with high entanglement entropy
Manuel Endres (Caltech)

5:30 - 6:30 Reception at PCTS

Many-body Physics with Synthetic Quantum Systems

Thursday, April 13, 2023

8:00-8:30 am Light Breakfast

Session 3 (Chair: Rhine Samajdar)

- 8:30-9:05 Exact Quantum Algorithms to Recognize Quantum Phases of Matter
Soonwon Choi (MIT)
- 9:05-9:40 Random insights into the complexity of tensor network calculations
Andrew Potter (UBC)
- 9:40-10:15 Complete quantum ergodicity: total exploration of the Hilbert space in dynamics
Wenwei Ho (National University of Singapore)

10:15-11:00 Coffee Break

- 11:00-11:35 Extending the Hubbard Model - Fractional Quantum Hall Physics, Dipolar Quantum Solids and Frustrated Quantum Magnets
Markus Greiner (Harvard)
- 11:35-12:10 Non-equilibrium quantum dynamics on a NISQ processor
Pedram Roushan (Google)

12:10-1:45 Lunch

Session 4 (Chair: Waseem Bakr)

- 1:45-2:20 A Universal Theory for Scalable Spin Squeezing
Norm Yao (Harvard)
- 2:20-2:55 Magnetism and spin squeezing using arrays of Rydberg atoms
Antoine Browaeys (CNRS)
- 2:55-3:30 Towards new frontiers of quantum science with dual-species atom arrays
Giulia Semeghini (Harvard)

Many-body Physics with Synthetic Quantum Systems

Thursday, April 13, 2023 (cont.)

3:30-4:00 Coffee Break

4:00-5:00 Physics Department Hamilton Colloquium
Room A-10, Jadwin Hall
*New avenues for Quantum simulations with atoms,
molecules and photons.*
Immanuel Bloch (MPQ)

Friday, April 14, 2023

8:00-8:30 am Light Breakfast

Session 5 (Chair: Zoe Yan)

8:30-9:05 Making & Probing Photon Fluids and Solids
Jon Simon (Stanford)

9:05-9:40 Topological phases with Rydberg atoms
Hans Peter Buchler (Stuttgart)

9:40-10:15 Non-equilibrium 1D Gases
David Weiss (Penn State)

10:15-11:00 Coffee Break

11:00-11:35 TBA
Christian Roos (Innsbruck)

11:35-12:10 Degenerate Fermi gases of
microwave-shielded polar molecules
Xinyu Luo (MPQ)

12:10-1:45 Lunch

Session 6 (Chair: Lawrence Cheuk)

1:45-2:20 Exploiting disorder to probe many-body dynamics in dense
spin systems
Paola Capellaro (MIT)

2:20-2:55 Fermion pairing, charge order and magnetization in an
attractive Fermi-Hubbard gas
Martin Zwierlein (MIT)

2:55-3:30 Topological pumping into strongly correlated prethermal
states
Ben Lev (Stanford)