



ASPEN CENTER
FOR PHYSICS



2023 WINTER CONFERENCE

ACTIVE MATTER IN COMPLEX ENVIRONMENTS

JANUARY 1 – 6, 2023

**Sunday evening welcome reception
Meetings Monday through Friday morning**

Active matter is a prominent area of research in soft matter and biological physics: it gives us the opportunity to learn new physics (active materials are out of equilibrium), engineer new materials (e.g., “intelligent” responsive materials), and understand more about biology (e.g., cells, migratory animals, and even subcellular motor proteins are active materials). While a tremendous amount of work has focused on the physics of active matter in bulk/unconfined environments, recent work is starting to demonstrate the rich physics associated with active matter in complex environments characterized by tortuosity, confinement, and complex interactions. In these cases, environmental interactions can strongly impact motility behaviors and collective phenomena like flocking, clustering, and phase separation. This Aspen Winter Conference will focus on this new direction in active matter research at the interface of soft matter physics, statistical and nonlinear physics, biology, and engineering.

This Conference will bring together a diverse group of leading theorists and experimentalists working on such problems across this rapidly developing field, in a wide range of systems and over a wide range of scales. Our ultimate goal is to foster new collaborations, clarify unifying/open questions for future research to address, and brainstorm new directions for the field. We will focus on five different themes:

- fundamentals of active matter in complex environments,
- collective behaviors,
- interactions with complex fluids,
- active matter through the lens of Biology and vice versa,
- and synthetic active materials and assemblies.

APPLICATION DEADLINE – AUGUST 31, 2022

PLEASE COMPLETE YOUR APPLICATION AT
<http://www.aspenphys.org/physicists/winter/winterapps.html>

Conference Website:
<https://dattalab.princeton.edu/aspen2023.html>

ORGANIZERS:

*Paulo Arratia, University of Pennsylvania
Moumita Das, Rochester Institute of Technology
Sujit Datta, Princeton University
Cynthia Reichhardt, LANL

*PHYSICIST IN CHARGE OF DIVERSITY

**PROPOSALS FOR THE 2024 WINTER CONFERENCES ARE INVITED
AND MUST BE SUBMITTED BY JANUARY 15, 2023**

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2023 WINTER CONFERENCE

SINGLE MOLECULE BIOPHYSICS

JANUARY 8 – 12, 2023

Sunday evening welcome reception

Sunday through Thursday evening

This will be the 11th biennial workshop on Single Molecule Biophysics (SMB) held at the Aspen Center for Physics (ACP), building on a successful series begun in 2001. The SMB meeting highlights recent progress in the field of single molecule biophysics, on both its experimental and theoretical frontiers. Topics vary somewhat from year to year. Biological systems covered in past meetings have included nucleic acid-based enzymes (polymerases, topoisomerases, helicases, etc.), nucleic acids (DNA, RNA), mechanoenzymes (myosin, kinesin, dynein, ATP synthase, flagellar motors), and aspects of molecular physiology (folding/unfolding, binding, signaling, and other biostructural changes). Featured experimental techniques have included advanced fluorescence, optical trapping, magnetic tweezers, scanned-probe microscopy, nanopores and super-resolution techniques. This workshop traditionally attracts an admixture of experimentalists and theorists.

Biologists and physicists with either newfound or longstanding interests in biophysics are strongly encouraged to apply: all levels of accomplishment are welcome. The meeting strives for a lively mix of students and professors. The SMB workshop has been oversubscribed in the past, so a higher priority will be assigned to those applicants presenting important new findings and who commit to remain for the duration of the meeting.

In the event of oversubscription, a limit of two representatives from each participating scientific group or collaboration will be adopted. We attempt to award each group or collaboration one short talk based on the applications accepted. All attendees are also invited to present posters. Prospective participants should submit the following:

- A short abstract (<200 words) of the proposed contribution, and be sure to include a title along with the names and institutional affiliations of all co-authors. The submitted abstracts will be ranked and used as a basis for admission.
- Indicate if you wish the abstract to be considered for a talk. Otherwise, a poster presentation will be assumed.
- Indicate that you intend to attend the full meeting, if admitted. If a partial attendance is anticipated, please be sure to supply the reason in your application.

Funding raised has traditionally been used to defray expenses for qualifying participants, especially younger scientists and those traveling a long distance. We plan to maintain this tradition. In addition, one junior applicant will receive a merit-based award from the Block Scholarship fund, and also be given a talk at the meeting.

APPLICATION DEADLINE – SEPTEMBER 1, 2022

PLEASE COMPLETE YOUR APPLICATION AT

<http://www.aspenphys.org/physicists/winter/winterapps.html>

Conference Website:

<https://jila.colorado.edu/smb>

ORGANIZERS:

Steven Block, Stanford University

***Thomas Perkins, JILA**

***PHYSICIST IN CHARGE OF DIVERSITY**

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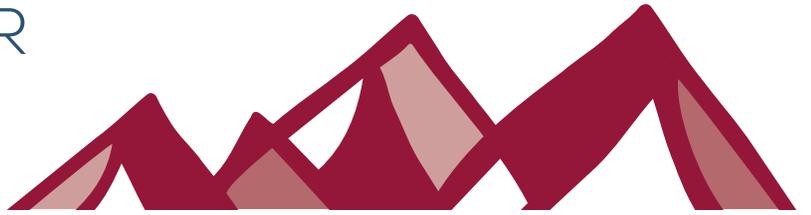
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2023 WINTER CONFERENCE

QUANTUM SIMULATION WITH QUANTUM HARDWARE

FEBRUARY 5 – 10, 2023

**Sunday evening welcome reception
Meetings Monday through Friday morning**

While simulation of quantum problems with classical computers has revolutionized fields like chemistry, materials science, condensed matter and nuclear physics, successful implementation of quantum algorithms has the potential to yield enormous additional computational capabilities for studying complex quantum systems. Over the past several decades there has been considerable progress in the development of quantum hardware. Currently, state of the art quantum machines, both analog and digital, are at the threshold where the computational power of these machines is about to exceed that of conventional computers.

At this Aspen Winter Conference, we will bring together people working on state-of-the-art quantum hardware, both analog and digital, with leading theoretical physicists in order to explore how to harness the power of quantum computers for solving a broad range of hard quantum problems. The meeting will foster collaborations by exploring what can be done with the current generation of quantum hardware, identifying quantum problems/models which may be solvable using quantum hardware in the future, and determining how to optimize quantum hardware for solving physics problems.

APPLICATION DEADLINE – SEPTEMBER 15, 2022

PLEASE COMPLETE YOUR APPLICATION AT
<http://www.aspenphys.org/physicists/winter/winterapps.html>

Conference Website:
<https://sites.google.com/levylab.org/aspen2023>

ORGANIZERS:

Susan N. Coppersmith, University of New South Wales

*Jeremy Levy, University of Pittsburgh

David Pekker, University of Pittsburgh

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2023 WINTER CONFERENCE

THEORETICAL PHYSICS FOR MACHINE LEARNING

FEBRUARY 26 – MARCH 3, 2023

Sunday evening welcome reception
Meetings Monday through Friday morning

Machine learning is undergoing a scientific revolution, with a succession of experimental triumphs. These empirical successes have often led to, and sometimes been inspired by, improved theoretical understanding that leans heavily on insight from physics. This Aspen Winter Conference will investigate the use of ideas from theoretical physics—in particular, high energy theory, condensed matter theory, and statistical mechanics—to better understand machine learning. We will bring together researchers from the theoretical physics and machine learning communities to discuss the physics of ML, with an eye towards both improved performance and progress on new challenges.

APPLICATION DEADLINE – SEPTEMBER 15, 2022

PLEASE COMPLETE YOUR APPLICATION AT
<http://www.aspenphys.org/physicists/winter/winterapps.html>

Conference Website:
<https://sites.google.com/view/phys4ml-2023/home>

ORGANIZERS:

Adam Brown, Stanford University & Google

Ethan Dyer, Google

****Paul Ginsparg**, Cornell University

***Guy Gur-Ari**, Google

Maithra Raghu, Samaya AI

*PHYSICIST IN CHARGE OF DIVERSITY

**SCIENTIFIC ADVISOR

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2023 WINTER CONFERENCE

EXTREME BLACK HOLES

MARCH 5 – 10, 2023

**Sunday evening welcome reception
Meetings Monday through Friday morning**

In the spirit of the Aspen X-games, this conference will highlight the astrophysics of “eXtreme black holes”, across the entire mass range from stellar to supermassive, covering a broad variety of environments (interacting binaries, dense star clusters, galactic nuclei), and observable signatures (gravitational waves, very high energy neutrinos, high-resolution imaging, time domain). This conference is a third in a series of Aspen Winter conferences in black hole astrophysics, but with a new focus on the breakthroughs in multi-messenger observations of black holes, and observations and theory that probe the extremes of their demographics.

Many recent discoveries in gravitational wave observations of black hole binaries, recent associations of very high energy neutrinos with accreting supermassive black holes, large samples of tidal disruption events from all-sky time domain surveys, new capabilities for X-ray monitoring of X-ray binaries and active galactic nuclei, and the first radio interferometric images of a central black hole in M87 and our own Milky Way, as well as theoretical developments in black hole binary formation channels, and numerical simulations of black hole formation and galaxy-black hole coevolution, make 2023 an exciting time for this meeting.

Topics covered by the meeting include:

- Time domain observations of accreting black holes of all mass scales across the electromagnetic spectrum
- New window on the stellar-mass black hole mass function from gravitational wave detections by LIGO and Virgo
- Shedding light on dormant black holes in galaxy nuclei with observations of tidal disruption events
- Hydrodynamics of collisions, mergers, and tidal disruptions
- Signatures of black hole growth through mergers from binary black holes and recoiling massive black holes
- Studying the accretion flow of a black hole from the smallest (the event horizon) to largest scales (relativistic jets)
- Evidence for intermediate-mass black holes, and their implications for the nature of black hole seeds
- The black hole at the center of our Milky Way

APPLICATION DEADLINE – SEPTEMBER 30, 2022

PLEASE COMPLETE YOUR APPLICATION AT

<http://www.aspenphys.org/physicists/winter/winterapps.html>

Conference Website:

<https://sites.northwestern.edu/aspenbh2023/>

ORGANIZERS:

***Suvi Gezari**, Space Telescope Science Institute
Andrea Ghez, University of California Los Angeles
Fred Rasio, Northwestern University
Steinn Sigurdsson, Pennsylvania State University

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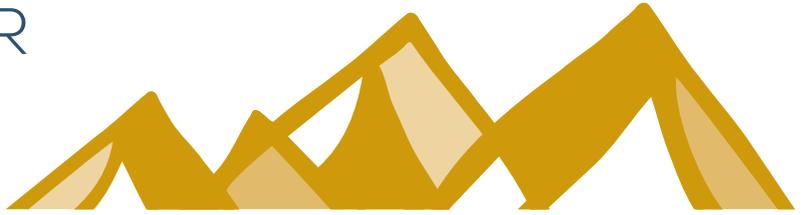
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2023 WINTER CONFERENCE

NOVEL QUANTUM STATES OF MATTER IN MOIRÉ MATERIALS

MARCH 12 – 17, 2023

**Sunday evening welcome reception
Meetings Monday through Friday morning**

The advent of moiré quantum materials has opened an entirely new highly tunable platform for exploring the interplay between electronic structure, interactions, symmetry, and topology. Starting with the discovery of correlated insulator states and superconductivity in magic angle twisted bilayer graphene, a growing variety of moiré systems have emerged, resulting in many novel correlated and topological phenomena, including new quantum anomalous Hall systems, generalized Wigner crystals, and integer and fractional Chern insulators, among others. This rich phenomenology has attracted enormous theoretical attention and, simultaneously, the interest of the entire repertoire of experimental condensed matter techniques to deepen our understanding of these exotic phases.

This conference will bring together the broad community of researchers interested in all these topics of moiré materials. We aim to have a healthy mix of experimentalists and theorists and will recruit high quality speakers in all of the topics mentioned above (see below). Finally, as the progress in the field is very fast, a few slots will be reserved for breaking news related to the conference topics.

APPLICATION DEADLINE – SEPTEMBER 30, 2022

PLEASE COMPLETE YOUR APPLICATION AT

<http://www.aspenphys.org/physicists/winter/winterapps.html>

Conference Website:

<https://acp.princeton.edu/>

ORGANIZERS:

Jennifer Cano, Stony Brook University

Pablo Jarillo-Herrero, MIT

Jie Shan, Cornell University

***Ali Yazdani**, Princeton University

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2023 WINTER CONFERENCE

EXOPLANET SYSTEMS AND STELLAR LIFE CYCLES: LATE-STAGE AND POST-MS SYSTEMS

MARCH 19 – 24, 2023

Sunday evening welcome reception
Meetings Monday through Friday morning

The growing population of exoplanets and the expanding repertoire of instruments and analysis techniques have moved the astrophysical domain of exoplanets from an era of individual system discoveries to a golden age of population-level scientific advances. With new and expected instruments and methods, we can examine the entire life cycles of planets and planetary systems. This Aspen Winter Conference will bring together leading scientific experts to explore the relationship between exoplanet demographics, stellar evolution, and stellar dynamics. The conference will focus on late-stage exoplanetary systems, including evolved stars and white dwarf hosts. Conference attendees will address and summarize what these relationships reveal about the underlying processes of the formation and evolution of planetary systems.

In this one-week, interdisciplinary workshop, we will bring together experts in time-domain astronomy, dynamics, stellar evolution, stellar rotation, asteroseismology, and planetary science to address two major open questions related to late-stage exoplanetary systems:

- What can we learn about planet formation and evolution from the demographics of exoplanets orbiting post-main-sequence stars?
- What can we learn about the chemical history and bulk planetary composition from accretion signatures and post-MS planetary ingestion investigations?

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PLEASE COMPLETE YOUR APPLICATION AT
<http://www.aspenphys.org/physicists/winter/winterapps.html>

Conference Website:
<https://sites.google.com/view/late-stage-exoplanets-2023/home>

ORGANIZERS:

Elisabeth Adams, Planetary Science Institute

Brian Jackson, Boise State University

*Melinda Soares-Furtado, University of Wisconsin Madison

Andrew Vanderburg, MIT

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PROSPECTING FOR NEW PHYSICS THROUGH FLAVOR, DARK MATTER, AND MACHINE LEARNING

MARCH 26 – 31, 2023

**Sunday evening welcome reception
Meetings Monday through Friday morning**

We have entered a new and exciting decade of particle physics. The field of Beyond the Standard Model (BSM) physics has rapidly transformed into a diverse program of new physics (NP) searches, including: high-pT searches at the LHC; precision tests of the SM, especially in the Higgs and flavor sectors; searches for new light particles at high-intensity experiments; and direct and indirect searches for Dark Matter across an increasingly broad range of masses and couplings. In addition, exciting developments in the field of machine learning are inspiring new and innovative methods to search for NP across this broad program.

The goal of this Aspen Winter Conference is to bring together theorists and experimentalists, both to discuss the latest experimental results in all of these areas and their various theoretical implications, as well as to explore novel techniques for the future exploration of BSM physics, including the prospects for NP searches at the High-Luminosity LHC and future colliders. Key topics that will be covered include: results from the first run of the Belle II flavor factory; the status of the flavor anomalies; new ideas to probe Dark Matter and dark sectors; direct and indirect searches for new physics at high energy experiments; precision measurements at small scale high-intensity experiments, e.g. g-2 and rare kaon decay experiments; and machine learning in particle physics.

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PLEASE COMPLETE YOUR APPLICATION AT
<http://www.aspenphys.org/physicists/winter/winterapps.html>

Conference Website:
<https://indico.fnal.gov/event/21471/>

ORGANIZERS:

***Wolfgang Altmannshofer**, University of California Santa Cruz
Patrick Fox, Fermilab
Stefania Gori, University of California Santa Cruz
David Shih, Rutgers University
Mike Williams, MIT

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