



2027 WINTER CONFERENCE

PHYSICS OF LIFE AT THE NANOSCALE

JANUARY 3 – 8, 2027

Sunday evening welcome reception
Meetings Monday through Friday morning

The Physics of Life at the Nanoscale conference focuses on progress and breakthroughs in the field of single-molecule biophysics, both from its experimental and theoretical frontiers. The conference is an evolution of the popular Single Molecule Biophysics workshops held at the ACP since 2001. New for this conference are “winter school” sessions in systems/synthetic biology and microfluidics that will highlight intersections with the single-molecule community and opportunities for collaboration and new research directions. Additional topics vary from year to year but include biological systems ranging from nucleic acid-based enzymes (polymerases, topoisomerases, helicases etc.), nucleic acids (DNA, RNA), mechanoenzymes (myosin, kinesin, dynein, ATP synthase, flagellar motors), and aspects of molecule physiology (folding/unfolding, binding, signaling, and other biostructural changes). The meeting also highlights technical and theoretical advances in single molecule biophysics in vitro and in living organisms using a range of techniques that incorporate fluorescence, optical tweezers, magnetic tweezers, scanned-probed techniques, nanopores, electrophysiology, cryo-EM, and super-resolution techniques.

Biologists and physicists with either a newfound or longstanding interest in biophysics are strongly encouraged to apply: all levels of accomplishment are welcome. We hope to continue our tradition of raising substantial funds that can subsidize meeting costs, including payment of ACP registration for all scientific participants and subsidizing meeting costs, especially for junior scientists and those traveling overseas. Similar workshops have been oversubscribed in the past, so a higher priority will be assigned to those applicants who present significant new findings and commit to remaining the entire duration of the meeting.

APPLICATION DEADLINE – SEPTEMBER 15, 2026

PLEASE COMPLETE YOUR APPLICATION AT:
<https://aspenphys.org/winter-conferences/>

CONFERENCE WEBSITE:
<https://sites.google.com/view/pln2027/home>

ORGANIZERS:
Aaron Hoskins, University of Wisconsin Madison
Thomas Perkins, JILA, University of Colorado & NIST
Allison Squires, University of Chicago

**PROPOSALS FOR THE 2028 WINTER CONFERENCES ARE INVITED
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**2027 WINTER CONFERENCE**

MULTIMESSENGER PROBES OF NEW SCALES IN PHYSICS

JANUARY 10 – 15, 2027

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

There is clear evidence for the existence of new physics beyond the Standard Model (SM), including the origin of neutrino mass, the nature of dark matter (DM) and the baryon asymmetry of the universe. Some theoretical considerations, such as the strong CP problem and the hierarchy between the electroweak scale and the Planck scale, also imply the existence of new physics scales. Addressing these fundamental questions demands the development of innovative theoretical frameworks and experimental strategies. A range of experiments across the intensity, energy, and cosmic frontier provide unique opportunities to explore fundamental extensions of the SM and address its shortcomings. This timely conference will consider new physics scales across the electromagnetic spectrum with a multi messenger approach to highlight important results from the ongoing experiments, and determine how they can be interpreted within the context of theoretical models. The workshop will offer guidance for the development of new experiments, and establish how the wide range of available energy scales can be used to search for new physics.

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CONFERENCE WEBSITE:
<https://sites.google.com/tamu.edu/multimessenger-aspen-2027/home?authuser=0>

ORGANIZERS:
Bhaskar Dutta, Texas A&M
Tao Han, University of Pittsburgh
Peisi Huang, University of Nebraska
Louis Strigari, Texas A&M

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2027 WINTER CONFERENCE

FUNDAMENTAL PHYSICS FROM THE PRIMORDIAL ERA WITH GALAXY SURVEYS

JANUARY 17 - 22, 2027

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

Understanding the one second before the hot Big Bang is central to many of the biggest open problems in physics, from the origin of dark matter and of structure in the Universe, to the nature of fundamental laws and quantum gravity. While this early phase of the Universe cannot be observed directly, its statistical properties are imprinted in the late-time distribution of cosmological tracers including dark matter and galaxies. These signals are becoming increasingly accessible through measurements of large-scale structure with galaxy surveys, for which a golden age is dawning (e.g., with DES, DESI, SPHEREx, Euclid, Rubin, and Roman); moreover, exciting opportunities at higher redshift and new analysis methods are actively being developed.

Now is a watershed moment for primordial cosmology, one which requires simultaneous participation from the entire community: theorists proposing physical mechanisms, phenomenologists modeling their manifestations as signals in large-scale structure, and observers informing the extent to which such signals are measurable. This Winter Conference will bring together experts across all aspects of this theory-to-observation spectrum to elucidate theory-motivated and observationally-accessible targets for primordial physics in the current and oncoming large-scale structure data deluge.

Topics will include:

1. Established and emerging theoretical models of physical processes in the primordial universe,
2. Observational channels of primordial physics in the late-time universe,
3. Detectability of primordial non-Gaussianity, primordial features, relativistic species, and axion-like particles in upcoming spectroscopic and photometric surveys,
4. Modeling of emerging precision large-scale structure probes of primordial physics (e.g., kinematic Sunyaev-Zel'dovich cross-correlations, tensor correlations with galaxy shapes),
5. Observational dataset complementarity (e.g. Cosmic Microwave Background weak lensing cross-correlation), new analysis methods, and systematics mitigation.

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**PLEASE COMPLETE YOUR APPLICATION AT
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**CONFERENCE WEBSITE
<https://aspen27-primordial-galaxies.netlify.app/>**

ORGANIZERS

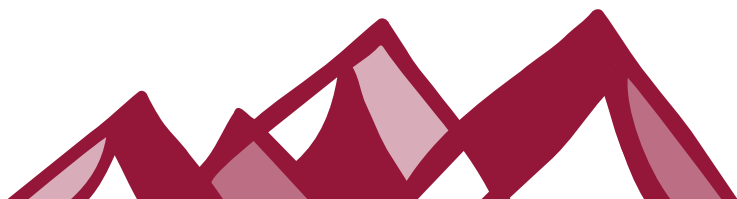
Daniel Green, University of California, San Diego
Mikhail Ivanov, Massachusetts Institute of Technology
Oliver Philcox, Stanford University
Jamie Sullivan, Massachusetts Institute of Technology

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ASPEN CENTER FOR PHYSICS

700 West Gillespie Street , Aspen, Colorado 81611
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**2027 WINTER CONFERENCE****EMERGENT QUANTUM MATTER,
ACROSS SCALES: FROM MOIRÉ
PLATFORMS AND QUANTUM
SIMULATION TO AI-DRIVEN THEORY****FEBRUARY 7 – 12, 2027****Sunday evening welcome reception
Meetings Monday through Friday morning**

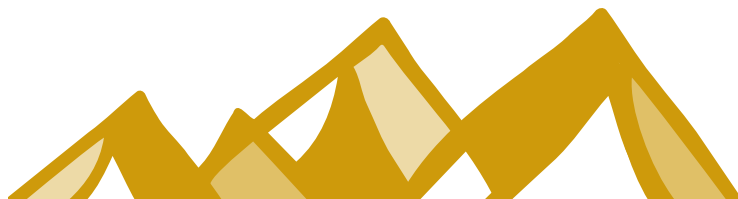
Modern quantum matter is witnessing a convergence of three communities that have largely advanced in parallel. One studies tunable synthetic systems such as moiré materials, cold atoms, and Rydberg arrays. A second probes complex bulk materials including cuprates, nickelates, and heavy fermion materials. A third is building novel computational frameworks like tensor networks and neural-network quantum states. These platforms differ by orders of magnitude in energy and length scale, yet they are governed by the same underlying Hamiltonians and exhibit the same universal phenomena: topological phases, superconductivity, and fractionalization. Moiré materials and quantum simulators offer pristine, tunable playgrounds in which individual interaction terms can be isolated, while bulk materials force us to confront the messier multi-orbital reality of quantum matter. At the same time, the rise of artificial intelligence for science provides a new language for the many-body problem where traditional methods fail. This conference brings together experts from solid-state experiment, AMO physics, and computational theory to uncover universal principles governing correlated matter across disparate platforms, and to test whether a unified framework can emerge.

APPLICATION DEADLINE – SEPTEMBER 15, 2026**PLEASE COMPLETE YOUR APPLICATION AT
<https://aspenphys.org/winter-conferences/>****CONFERENCE WEBSITE****<https://quantum-matter-aspen-winter-2027.netlify.app/>****ORGANIZERS**

Charlotte Bøettcher, Stanford University
Debanjan Chowdhury, Cornell University
Dahlia Klein, University of Chicago
Yahui Zhang, Johns Hopkins University

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**2027 WINTER CONFERENCE****WORLD MODELS: DISCOVERING AND
SIMULATING PHYSICS AT SCALE****FEBRUARY 28 – MARCH 5, 2027**

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

Physics has always advanced by distilling complex phenomena into compact, predictive descriptions — effective theories, conservation laws, and symmetries. Yet modern experiments and simulations now produce vast streams of high-dimensional data — time-resolved images, particle tracks, turbulent flows, astronomical surveys, and molecular trajectories — that can no longer be understood by hand. In parallel, advances in self-supervised learning, world models, and Joint Embedding Predictive Architectures (JEPAs) have created powerful general-purpose tools for learning predictive, invariant structure directly from data, at scales and in regimes where classical analytical approaches struggle. Bringing together researchers in theoretical and experimental physics, machine learning, and the quantitative sciences, the program centers on three themes — self-supervised learning as a principle of scientific inference; world models as a unifying framework for physical systems; and the automated discovery of physics structure from high-dimensional data. Sessions will mix invited and contributed talks, poster sessions with strong early-career participation, and afternoon breakout discussions, with a sustained emphasis on open science—shared code, public datasets, and common benchmarks.

APPLICATION DEADLINE – SEPTEMBER 30, 2026

PLEASE COMPLETE YOUR APPLICATION AT
<https://aspenphys.org/winter-conferences/>

CONFERENCE WEBSITE
<https://wmw-aspen.github.io/>

ORGANIZERS
Randall Balestriero, Brown University
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Julia Kempe, New York University
Yann LeCun, New York University

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2027 WINTER CONFERENCE

COSMOLOGICAL SIGNALS FROM THE DARK AGES TO THE PRESENT

MARCH 7 - 12, 2027

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

The early Universe, from the dark ages through cosmic dawn, reionization, and beyond, holds the key to understanding the first luminous structures and their role in shaping cosmic history. Rapid advances in theory, simulations, and observations are converging to reveal this exciting period for the first time.

Our goal is to foster collaboration and synthesis across disciplines to interpret current and upcoming data, refine theoretical frameworks, and chart the next decade of discovery in high-redshift cosmology.

Topics to be covered include:

- Formation of the First Luminous Structures: The first stars, star clusters, and black holes.
- Theory of the 21-cm Signal: Simulations and predictions for the dark ages, cosmic dawn, and the epoch of reionization.
- Observations of the High-Redshift Universe: Current and upcoming surveys targeting 21-cm emission, line intensity mapping, and high-redshift sources.
- Synergies Across Probes and Simulations: Integrating theoretical models, numerical simulations, and multi-wavelength observations.
- Connecting the Early Universe to Current Observations: Linking the astrophysics and cosmology that can be studied with the first galaxies to JWST and various cosmological probes.

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PLEASE COMPLETE YOUR APPLICATION AT
<https://aspenphys.org/winter-conferences/>

CONFERENCE WEBSITE
<http://wise-obs.tau.ac.il/~barkana/darkages.html>

ORGANIZERS
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**2027 WINTER CONFERENCE****FRONTIERS OF QUANTUM SCIENCE
WITH ATOM AND MOLECULE
TWEezer ARRAYS****MARCH 14 – 19, 2027****Sunday evening welcome reception
Meetings Monday through Friday morning**

Optical tweezer arrays have burst onto the quantum technology scene, providing unprecedented control over atomic and molecular systems. These advancements have accelerated academic and industrial progress in these systems, driving rapid development of new capabilities and scientific discoveries.

The goal of this Winter conference is to provide a venue for the exchange of ideas that drive innovation and push the frontier of this field. In the two years since this conference was first held, the field has advanced significantly, and the number of tweezer-based quantum companies has more than doubled. To keep pace with this rapidly evolving landscape, we invite theorists and experimentalists working with the tweezer-array platform to join us in Aspen for this Winter Conference. The program will feature talks from both academia and industry highlighting theoretical and experimental advances, as well as the future potential of tweezer arrays. We invite contributions from a wide range of research interests, career stages and institutional affiliations.

Among the scientific applications for tweezer arrays, we will consider the following:

- quantum simulation of many-body physics;
- quantum information processing;
- ultracold quantum chemistry;
- quantum sensing and metrology;
- new optical tweezer techniques

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<https://aspenphys.org/winter-conferences/>**CONFERENCE WEBSITE**
<https://aspentweezerarrays2027.org/>**ORGANIZERS**
Alex Burgers, University of Michigan
Jacob Covey, University of Chicago
Matt Jaffe, Montana State University
Nelson Oppong, California Institute of Technology**PROPOSALS FOR THE 2028 WINTER CONFERENCES ARE INVITED
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2027 WINTER CONFERENCE

ADAPTIVE QUANTUM CIRCUITS: FROM NONEQUILIBRIUM MANY-BODY PHYSICS TO QUANTUM INFORMATION PROCESSING

MARCH 21 – MARCH 26, 2027

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

Adaptive quantum circuits, in which mid-circuit measurements are used to condition subsequent quantum operations, are rapidly becoming available across several experimental platforms. These circuits offer a promising route from noisy intermediate-scale devices toward early fault-tolerant quantum technologies, with potential applications to state preparation, quantum algorithms, and error correction.

At the same time, adaptive circuits provide a versatile setting for exploring nonequilibrium quantum matter. They exhibit measurement-induced phase transitions, novel mixed-state phases with long-range or topological order, and deep connections to classical dynamical systems, statistical mechanics, and field theory. Understanding which features of these phenomena are intrinsically quantum, experimentally observable, and useful for computation is a central challenge for the field.

This conference will bring together researchers from academia and industry working at the intersection of quantum information science, condensed matter physics, and AMO physics. Topics will include adaptive quantum algorithms, near-term experimental implementations, measurement-induced criticality, mixed-state phases and topology, quantum error correction, and the stability of adaptive protocols to noise and imperfections. By placing theoretical developments in direct contact with emerging experimental capabilities, the meeting aims to clarify the role of adaptivity as both a tool for quantum technologies and a platform for new many-body physics.

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<https://aspenphys.org/winter-conferences/>

CONFERENCE WEBSITE
<https://aqc2027.condmat.org/>

ORGANIZERS
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Crystal Noel, Duke University
Maika Takita, IBM
Justin Wilson, Louisiana State University

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