ASPEN CENTER FOR PHYSICS

2026 WINTER CONFERENCE

PHYSICS AND ASTROPHYSICS OF NEUTRINO-DENSE ENVIRONMENTS

JANUARY 4 – 9, 2026

Sunday evening welcome reception
Meetings Monday through Thursday morning

A thorough understanding of neutrino flavor transformation is essential for interpreting observations of neutron star mergers, core-collapse supernovae, and the early universe. Despite its significance, its impact on the dynamics of these events, as well as on their multi-messenger signals and nucleosynthesis yields, remains poorly understood. This hinders our ability to connect kilonovae observations, including recently obtained James Webb Space Telescope (JWST) spectra, with the nuclear physics of neutron-rich isotopes being unveiled at facilities such as the Facility for Rare Isotope Beams (FRIB) at Michigan State University. In the cosmological context, this physics is important for exploring lepton number constraints, and vetting beyond-standard-model possibilities with light element abundances, N_{eff} , the sum of neutrino masses, etc. In turn, these quantities are key targets for cosmic microwave background (CMB) Stage-4 experiments. Addressing this challenge requires expertise beyond the scope of any single research group or discipline. Progress demands a concerted, collaborative effort that bridges efforts in time-domain astronomy and cosmology, nuclear/particle theory—ranging from magnetohydrodynamics to quantum many-body theory—and neutrino experiments. The Aspen Center for Physics winter workshop is designed to unite experts across these domains, making explicit connections between the fundamental physics of neutrino flavor transformations with planning and interpreting observations in cosmology and transient science.

APPLICATION DEADLINE – SEPTEMBER 15, 2025

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

Conference Website:
https://indico.phys.utk.edu/event/169/

ORGANIZERS:

George Fuller, University of California San Diego
***Anna Ho,** Cornell University
Gail McLaughlin, North Carolina State University
David Radice, Pennsylvania State University
Sherwood Richers, University of Tennessee Knoxville

*SCIENTIFIC ADVISOR

PROPOSALS FOR THE 2027 WINTER CONFERENCES ARE INVITED AND MUST BE SUBMITTED BY JANUARY 15, 2026

ASPEN CENTER FOR PHYSICS
700 W Gillespie Street
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2026 WINTER CONFERENCE

THEORETICAL PHYSICS FOR ARTIFICIAL INTELLIGENCE

JANUARY 11 – 16, 2026

Sunday evening welcome reception
Meetings Monday through Friday morning

Some of the world's most ambitious and consequential experiments are taking place not in particle accelerators or space telescopes but in silicon, training ginormous neural networks. The results have been transformative, yet much of the progress has been driven by empirical advances, with theoretical understanding struggling to keep pace. This meeting will explore how the tools and insights of theoretical physics can deepen our understanding of modern artificial intelligence.

We will bring together physicists and computer scientists, with a shared goal of illuminating the principles underlying successful machine learning methods—and ultimately guiding the development of better architectures and algorithms.

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

Conference Website:
https://sites.google.com/view/aspen2026/home

ORGANIZERS:
Adam Brown, Google DeepMind & Stanford University
Ethan Dyer, Anthropic
Dmitry Krotov, IBM Research & MIT
Eva Silverstein, Stanford University

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2026 WINTER CONFERENCE

PAVING THE WAY TO NEW DISCOVERIES IN PARTICLE PHYSICS

FEBRUARY 1 – 6, 2026

Sunday evening welcome reception
Meetings Monday through Friday morning

Particle physics is living through exciting times, questioning paradigms of past decades. The 2026 Aspen Winter Physics Conference "Paving the Way to New Discoveries in Particle Physics" will provide a forum to discuss novel theoretical and experimental ideas, and techniques addressing the challenges posed by the vast amount of recent data. The program focuses on precision electroweak physics including Higgs bosons and top quarks, QCD at high energies and in heavy-ion collisions, dark matter and messengers to the dark sector, direct and indirect searches for new particles and interactions, recent developments in theory, science at future accelerator facilities, the interplay of particle physics and cosmology, advances based on artificial intelligence, and the role of quantum devices, quantum algorithms, and entanglement in particle physics. A dedicated poster session will highlight research at the intersection of machine learning, quantum science, and particle physics.

APPLICATION DEADLINE – SEPTEMBER 15, 2025

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

Conference Website:
https://indico.cern.ch/event/1562147/

ORGANIZERS:

Marcela Carena, Perimeter Institute & University of Chicago/Fermilab
Greg Landsberg, Brown University
Matthias Neubert, Johannes Gutenberg University Mainz and MITP & Cornell University
Giulia Zanderighi, Max Planck Institute for Physics and Technical University Munich

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2026 WINTER CONFERENCE

GENERALIZED SYMMETRIES AND DEFECTS IN QFT AND GRAVITY

FEBRUARY 8 - 13, 2026

Sunday evening welcome reception
Meetings Monday through Friday morning

Recent developments have shown that generalized symmetries—such as higher-form, non-invertible, and categorical symmetries—play a crucial role in constraining the dynamics of quantum field theories, characterizing defects, and uncovering new dualities. In gravity, on the other hand, it has been long conjectured that there are no charge conservation laws in its UV. This is also expected to extend to generalized symmetries, where their absence can constrain the structure of possible UV completions of gravity as well as the spectrum of gravitational excitations. These ideas have also found profound applications in the swampland program, where generalized symmetries impose sharp constraints on the landscape of consistent low-energy effective theories, as well as in holography, where they govern aspects of bulk/boundary correspondence and entanglement structures. Complementing this, modern ideas in topological field theory play a strong role in the study of generalized symmetries and defects, and one goal of this conference is to catalyze a stronger engagement of mathematicians with problems in gravity as well as the relation to topological theories (non-semisimple ones) that are relevant in this context. This is particularly important e.g. in the study of low-dimensional gravity and the relation to Liouville topological field theory. The meeting will bring together experts in these fields to consolidate progress, including the mathematical formalism of higher-categories, implications for the classification of topological phases, and consequences for black hole information and gravitational anomalies.

APPLICATION DEADLINE – SEPTEMBER 15, 2025

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

Conference Website:
https://sites.google.com/view/aspengensym/home

ORGANIZERS:

Ibrahima Bah, Johns Hopkins University
Dan Freed, Harvard University
Sakura Schafer-Nameki, University of Oxford
Constantin Teleman, University of California Berkeley

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2026 WINTER CONFERENCE

FUNDAMENTAL PHYSICS IN SPACE WITH QUANTUM SENSORS

FEBRUARY 22 – 27, 2026

Sunday evening welcome reception
Meetings Monday through Friday morning

The space environment has long offered unique conditions and opportunities to explore fundamental physics beyond the Standard Model with quantum sensors, dating back to Gravity Probe A in 1976. The current coming of age of quantum technology has yielded new types of quantum sensors with orders of magnitude improved precision including atomic clocks with fractional precision and accuracy below 10^(-18) and atom interferometers targeting equivalence principle test precision below 10^(-17). These sensors have the potential to make breakthrough discoveries about the nature of gravity, dark matter, and dark energy, explore quantum mechanics in new regimes enabled by microgravity, and perform gravitational wave astronomy in frequency bands outside the reach of LIGO or upcoming LISA experiments, among other applications called out in the 2023 NASA Biological & Physical Sciences Decadal Survey. The goal of this meeting is to bring together the fundamental physics, quantum sensor, and space instrument communities in order to brainstorm ideas for space missions with quantum sensors that can shed light on fundamental physics beyond the Standard Model (BSM).

APPLICATION DEADLINE – SEPTEMBER 15, 2025

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

Conference Website:
https://sites.google.com/view/fundamental-physics-in-space

ORGANIZERS:

Oliver Buchmueller, Imperial College London/CERN
Emily Caldwell, National Institute of Standards and Technology
Paul Hamilton, University of California Los Angeles
David Leibrandt, University of California Los Angeles

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2026 WINTER CONFERENCE

THE FIRST BILLION YEARS OF THE UNIVERSE: FIVE QUESTIONS IN FIVE DAYS

MARCH 1 – 6, 2026

Sunday evening welcome reception
Meetings Monday through Friday morning

In 2026, it will have been 10 years since the last major conference at the ACP about galaxy formation during the first billion years of the Universe's history. In this interval, the emergence of JWST and ALMA have shifted the knowledge-space from relatively mature galaxies some 1 billion years after the Big Bang to the emergence of the first, nearly chemically pristine galaxies likely undergoing their first bursts of star formation a full 700 Myr earlier. The result from these observations is a complete upending of our understanding of the formation of the first galaxies in the Universe. Because of this, we will host a conference at the ACP one decade later, to critically examine 5 emerging challenges in the Epoch of First Light. The major goal of this workshop is to accelerate the community toward finding answers to each of the following 5 outstanding puzzles:

- How are galaxies growing so rapidly to high luminosities and masses at early times?
- What is the physical nature of LRDs, and their potential connection to early black hole growth?
- What drives the first quenching (or miniquenching) episodes in the early Universe?
- How does dust grow so rapidly in the first billion years?
- What drives the photon budget crisis during the EoR?

APPLICATION DEADLINE – SEPTEMBER 30, 2025

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

Conference Website:
https://astro.ufl.edu/aspen-first-billion-years/

ORGANIZERS:

Desika Narayanan, University of Florida
Erica Nelson, University of Colorado Boulder
Pascal Oesch, University of Geneva & Copenhagen
Alexandra Pope, University of Massachusetts Amherst

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2026 WINTER CONFERENCE

PHYSICS OF THE CYTOPLASM: LINKING BIOPHYSICS TO BIOLOGICAL FUNCTION

MARCH 22 – 27, 2026

Sunday evening welcome reception
Meetings Monday through Friday morning

The cytoplasm is now recognized as a complex, dynamic, and actively regulated environment. Recent discoveries have revealed profound links between the physical properties of the cytoplasm and fundamental biological processes, making this an exceptionally timely and important area of investigation. This conference aims to unite physicists and biologists at the forefront of this rapidly evolving field to foster the exchange of data, ideas, and emerging concepts.

Themes include but are not limited to:

- The role of phase transitions in self-organization and signaling.
- Regulation of cellular biomass density.
- The connection between membrane potential and mechanics.
- The effect of mechanical forces on the nucleus.
- Self-organization and regulation of the cytoskeleton.
- Physiology of the cell and tissues
- Homeostatic regulation and signal transduction.

Goals include:

- Showcase cutting-edge research: Present the latest findings on the physical properties of the cytoplasm and their impact on cellular processes, with a focus on both observational data and mechanistic studies.
- Foster interdisciplinary collaboration: Bring together physicists, biologists, cell biologists, and biophysicists to facilitate cross-disciplinary discussions and collaborations aimed at elucidating underlying mechanisms.
- Identify emerging concepts: Explore new research directions and identify key questions for future investigation, particularly those focused on bridging the gap between observation and mechanism.
- Promote knowledge exchange: Provide a platform for the exchange of data, techniques, and ideas, with an emphasis on experimental and computational approaches that can help uncover the molecular mechanisms linking cytoplasmic physics to cellular function
- By bringing together leading experts in these interconnected fields, this conference will catalyze progress in understanding the fundamental role of cytoplasmic physics in health and disease.

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

Conference Website:
https://sites.google.com/view/physicsofcytoplasm2026/home

ORGANIZERS:

Markus Basan, Harvard University
Jens Elgeti, Forschungszentrum Jülich
Avik Mukherjee, Harvard University

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2026 WINTER CONFERENCE

ALTERMAGNETISM AND UNCONVENTIONAL MAGNETIC ORDERS IN QUANTUM MATERIALS

MARCH 29 - APRIL 3, 2026

Sunday evening welcome reception
Meetings Monday through Friday morning

Magnetism is one of the most widely investigated quantum states of matter, as it provides a unique window into the collective microscopic behavior of electronic degrees of freedom. Proposals for novel types of magnetic order have historically triggered intense research efforts in the condensed matter physics community, from Landau's and Néel's proposals of antiferromagnets in the 1930s and 1940s to Anderson's proposal of spin liquids in the 1970s. More recently, in 2022, a new framework was proposed to classify collinear magnetic phases using the mathematical tool of spin groups, which sparked a flurry of research activity on unconventional magnetic phases. Among these unconventional magnetic phases, one state has received significant attention from various communities in condensed matter physics: altermagnets. Defined by their invariance with respect to combined rotation and time reversal, one of the main appeals of altermagnetic states is that they share similar properties with both antiferromagnets (a vanishing net magnetization) and ferromagnets (a spin-split band structure). On the one hand, these properties make altermagnets promising for applications in spintronics. On the other hand, they reveal close connections to important open problems in diverse condensed matter systems. This rich connectivity between different areas of condensed matter physics and altermagnetism is accompanied by a remarkable versatility in the types of materials that realize this phase of matter. The recent surge of interest in altermagnetism and, more generally, in unconventional magnetism, makes this a timely topic for an Aspen Winter Conference. The unique format of this conference will provide an ideal opportunity to bring together this vast and diverse community to find common ground and discuss the latest progress in the field, the open problems, ongoing challenges, and new research directions. Featured topics include: new materials realization of altermagnetism; thermodynamic, transport and spectroscopic signatures of altermagnetism in candidate systems; p-wave magnets and other non-collinear unconventional magnetic phases; impact of electronic correlations in altermagnetic phases; topological phenomena enabled by unconventional magnetism; interplay between altermagnetism and superconductivity.

APPLICATION DEADLINE – SEPTEMBER 30, 2025

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

Conference Website:
https://sites.google.com/view/aspen-altermagnetism-2026/

ORGANIZERS:

Riccardo Comin, Massachusetts Institute of Technology
Rafael Fernandes, University of Illinois Urbana-Champaign
Karin Rabe, Rutgers University
Jeroen van den Brink, Leibniz Institute for Solid State and Materials Research

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