P5 Town Hall at Fermilab and Argonne

Report of Abstracts

https://indico.fnal.gov/e/58272

Abstract ID : **23**

Tera-Z at FCCee: a b physics factory for the future

Content

High statistics studies of the b quark have provided essential information on the standard model. Studies of CP violation in the b sector have indicated a need for beyond-the-standard model sources of CP violation, and studies of rare b decays have provided both constraints on new physics models and now tantalizing hints of beyond-the-standard-model lepton flavor violation. LHCb and Belle-2 will continue this program. Beyond these, the Tera-Z running at FCCee will provide samples of 5 x 10^{12} b's to allow continued higher-precision studies of the b quark. In addition, Tera-Z will extend the precision on measurements on the tau lepton.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

Please add details of experiment/project that this abstract corresponds to?

Primary author: ENO, Sarah (U. Maryland)

Presenter: ENO, Sarah (U. Maryland)

Contribution Type: Fermilab open session

Status: ACCEPTED

Submitted by **ENO, Sarah** on **Thursday, March 9, 2023**

Abstract ID : **54**

Muon Collider: Today's R&D for Tomorrow's Discoveries

Content

Future high energy colliders are essential to unravel the mysteries of the universe. The question is how best to access higher energies. After decades of physically larger and larger pp and e+e- machines, a compact and power-efficient muon collider would represent a paradigm shift for the field of particle physics. In this remark, I'll discuss why a multi-TeV Muon Collider is a compelling successor to the LHC, well suited for Fermilab's long-term future, and why it is imperitive we support dedicated R&D today.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

Muon Collider R&D

Primary author: DIPETRILLO, Karri (Fermilab)

Presenter: DIPETRILLO, Karri (Fermilab)

Contribution Type: Fermilab open session

Status: ACCEPTED

Submitted by **DIPETRILLO, Karri** on **Saturday, March 11, 2023**

Abstract ID : **57**

Fermilab Accelerator Proton Intensity Upgrade aka PIP-III

Content

I am early career accelerator scientist on the Fermilab Central Design Group (CDG) on Proton Intensity Upgrade (PIU). The first objective of this group is to develop reliable accelerator upgrade scenarios for 2.4 MW upgrade of DUNE/LBNF program. The next objective is to consider broader HEP opportunities and their relation to Fermilab upgrades - especially dark sector searches and muon physics programs. I will share my perspective on the synergies and tensions in the various paths forward.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

Fermilab 2.4 MW LBNF Upgrade, aka PIP-III aka Proton Intensity Upgrade (PIU)

Primary author: ELDRED, Jeffrey (Fermilab)

Presenter: ELDRED, Jeffrey (Fermilab)

Contribution Type: Fermilab open session

Status: ACCEPTED

Submitted by **ELDRED, Jeffrey** on **Monday, March 13, 2023**

Abstract ID : **59**

The GRAMS (Gamma-Ray and AntiMatter Survey) Project

Content

GRAMS (Gamma-Ray and AntiMatter Survey) is a proposed balloon/satellite mission that will be the first to target both MeV gamma-ray observations and antimatter-based indirect dark matter searches with a LArTPC (Liquid Argon Time Projection Chamber) detector. With a cost-effective, large-scale LArTPC, GRAMS can open up a new window into the poorly explored region of the MeV sky and be a pathfinder for future scientific research in the era of multi-messenger astronomy. GRAMS is also capable of extensively exploring dark matter parameter space via antimatter measurements. In particular, low-energy antideuteron and antihelium measurements can offer essentially background-free dark matter searches.

Please select if remarks will be in person or on zoom

On zoom

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

Gamma-ray observations and antimatter-based indirect dark matter searches

Primary author: ARAMAKI, Tsuguo (Northeastern University)

Presenter: ARAMAKI, Tsuguo (Northeastern University)

Contribution Type: Fermilab open session

Comments:

This talk is for the GRAMS collaboration

Status: ACCEPTED

Submitted by **ARAMAKI, Tsuguo** on **Tuesday, March 14, 2023**

Abstract ID : **61**

Time Slicing of Neutrino Fluxes in Oscillation Experiments at Fermilab

Content

The next generation of long baseline neutrino experiments aims to increase proton beam power to multi-MW level and make use of massive detectors to overcome the limitation of event statistics. The DUNE experiment at LBNF will test the three neutrino flavor paradigm and directly search for CP violation by studying oscillation signatures in the high intensity νμ (anti-νμ) beam to νe (anti-νe) measured over a long baseline.
As long baseline neutrino experiments are entering a precision era, reduction in the systematic errors to the level of a few percent is necessary to attain their physics goals. The neutrino-nucleus interaction cross sections are among the most challenging sources of systematic errors. In this talk, an innovative neutrino beam research and development technique is presented to constrain the cross-section uncertainty and ensure that DUNE meets its objectives by performing time-slicing of the neutrino flux, called the "stroboscopic approach". By exploiting the correlation between the true neutrino energy and the measured neutrino arrival time, this technique selects different neutrino energy spectra from a wide-band neutrino beam. It uniquely allows access to true energy information at the Far detector, which is not possible from any other existing part of the DUNE experiment.
Three different thrusts are necessary for the application of stroboscopic approaches, namely: 1) creation of short (O(100ps)) proton bunch length, 2) implementation of fast timing to get equivalent time resolution in the detectors, 3) establishment of synchronization between the time at the detector and time of the bunch-by-bunch proton at the target. This talk will explain how the three different thrusts emerge from the same objective of understanding how the stroboscopic approach brings its own critical contribution to DUNE and US neutrino physics. Obtaining a better understanding of the cross sections is critical for DUNE experiment and neutrino physics as a whole and US accelerator-based neutrino beams will benefit from this novel technique.

Please select if remarks will be in person or on zoom

On zoom

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

LBNF/DUNE

Primary author: GANGULY, Sudeshna (Fermilab)

Presenter: GANGULY, Sudeshna (Fermilab)

Contribution Type: Argonne open session

Status: ACCEPTED

Submitted by **GANGULY, Sudeshna** on **Tuesday, March 14, 2023**

Abstract ID : **70**

High-Power Targetry R&D for Next-Generation Accelerator Facilities

Content

As next-generation accelerator target facilities, such as the Long-Baseline Neutrino Facility (LBNF) at Fermilab, become increasingly more powerful and intense, high power target systems face key technical challenges. Devices such as beam windows and secondary particle-production targets are continuously bombarded by high-energy high-intensity pulsed proton beams to produce secondary particles for several High Energy Physics (HEP) experiments. Energy deposition from the primary beam induces near instantaneous heating (thermal shock) and microstructural changes (radiation damage) in the beam-intercepting materials. Both thermal shock and radiation damage ultimately degrade the performance and lifetime of targets and have been identified as the leading cross-cutting challenges of high-power target facilities. Several facilities have already had to limit their beam power because of the survivability of their targets and windows, rather than as a limitation of the accelerators themselves. As beam power in next-generation multi-megawatt accelerator target facilities continue to increase, there is a pressing need to address the material challenges to avoid limiting the scope of future HEP experiments. This talk will highlight the critical materials R&D needs to address the challenges of high-power targets.

Please select if remarks will be in person or on zoom

On zoom

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

LBNF, Mu2e-II, Muon collider, etc.

Primary author: AMMIGAN, Kavin (Fermi National Accelerator Laboratory)

Presenter: AMMIGAN, Kavin (Fermi National Accelerator Laboratory)

Contribution Type: Fermilab open session

Status: ACCEPTED

Submitted by **AMMIGAN, Kavin** on **Wednesday, March 15, 2023**

Abstract ID : **71**

Measuring Neutrino Oscillation Parameters With Atmospheric Neutrinos This Decade

Content

Frontier: Neutrino
Experiment: Multi-experiments (IceCube-Upgrade, SuperKamiokande-Gd, KM3NeT-ORCA)

In the current agenda, atmospheric neutrinos are not listed in any contribution title. In this contribution, I will highlight the expected capabilities of atmospheric neutrino experiments that aim to operate this decade and how they can help determine the oscillation parameters. I point out that atmospheric neutrino experiments currently under construction will determine the neutrino ordering (at more than 5 sigma), independent of JUNO, by 2030. I will request endorsement of this valuable program in the P5 report. Finally, I will also discuss other synergies with long-baseline accelerator experiments.

Please select if remarks will be in person or on zoom

On zoom

Do you describe your self as early career?

no

Please add details of experiment/project that this abstract corresponds to?

Primary author: Prof. ARGÜELLES DELGADO, Carlos (Harvard University)

Presenter: Prof. ARGÜELLES DELGADO, Carlos (Harvard University)

Contribution Type: Argonne open session

Status: ACCEPTED

Submitted by **Prof. ARGÜELLES DELGADO, Carlos** on **Wednesday, March 15, 2023**

Abstract ID : **72**

Next Generation Instrumentation for Ultra-High-Energy Cosmic Rays (UHECR)

Content

As solicited by the Snowmass Cosmic Frontier 7 and as a major effort of the international UHECR community, we have produced a whitepaper about the status and future of ultra-high-energy cosmic rays (UHECR) physis [Astropart. Phys. 149 (2023) 102819 - arXiv:2205.05845] with about 100 authors and many additional endorsers. Part of the whitepaper is an instrumentation roadmap of the large-scale experiments needed for both the particle and astrophysics goals of UHECR during the next two decades. The currently upgraded Pierre Auger Observatory and also the Telescope Array will drive UHECR physics during this decade, preparations for the next generation of complementary experiments is mandatory. This short presentation will give an overview of the science cases and the instrumentation roadmap concluding the whitepaper, which includes next generation experiments such as POEMMA as a space-borne detector, and the GCOS as a ground-based observatory.

Please select if remarks will be in person or on zoom

On zoom

Do you describe your self as early career?

Please add details of experiment/project that this abstract corresponds to?

Overview on next-generation UHECR including POEMMA, GRAND, GCOS

Primary author: SCHROEDER, Frank (University of Delaware)

Presenter: SCHROEDER, Frank (University of Delaware)

Contribution Type: Argonne open session

Comments:

I have been one of the lead conveners of the UHECR whitepaper solicited by CF7 in Snowmass. About early career question: I am at the threshold from early to mid-career as I have received tenure in this academic year.

Status: ACCEPTED

Submitted by **SCHROEDER, Frank** on **Wednesday, March 15, 2023**

Abstract ID : **73**

The need to support the Pierre Auger Observatory and the Telescope Array Project into the 2030s

Content

To maximize the scientific value extracted from current investments, both the Pierre Auger Observatory and the Telescope Array Project must be supported into the 2030s. This need has become clear during the writing of a white paper on Ultra-High-Energy Cosmic Ray (UHECR) for the Snowmass process \[Astropart. Phys. 149 (2023) 102819\]. The reasons for this term of support are manyfold, but two crucial aspects will be highlighted in this short presentation. First, this duration would provide a decade of data accumulation with instruments now completing extensive upgrades. These upgrades have been designed to target critical questions in particle physics and astrophysics, but require this level of exposure to make good on their potential. Second, the next generation of UHECR experiments must be cross-calibrated with existing observatories to ensure consistency in their measurements, and they are not expected to begin taking data until 2030.

Please select if remarks will be in person or on zoom

On zoom

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

Pierre Auger Observatory and the Telescope Array Project

Primary author: MAYOTTE, Eric (Colorado School of Mines)

Presenter: MAYOTTE, Eric (Colorado School of Mines)

Contribution Type: Argonne open session

Comments:

I am currently a Post Doc and one of the lead conveners of the solicited Snowmass white paper on ultra-high-energy cosmic rays.

Status: ACCEPTED

Submitted by **MAYOTTE, Eric** on **Wednesday, March 15, 2023**

Abstract ID : **75**

High-Intensity Precision Muonium Physics at Fermilab

Content

Three fundamental searches or measurements can be made with muonium (M), a hydrogenic μ^+e^- bound state: the search for charged-lepton flavor violation via M-$\overline{\text{M}}$ oscillations, the M atomic spectrum, and the gravitational acceleration ($\overline{g}$) of antimatter in Earth's field. M-$\overline{\text{M}}$ transitions are allowed, but highly suppressed, via neutrino mixing, and would yield a striking experimental signature; their observation would signal new doubly charged-lepton-flavor-violating physics coupling to 2nd-generation elementary particles. The M atomic spectrum is a precision test of QED, free of hadronic and finite-size effects. $\overline{g}$ has yet to be directly measured; measuring it with muonium is the only way to test the gravitational coupling of 2nd-generation particles. An unexpected outcome could change our understanding of gravity, the universe, and the existence of a fifth force. The PIP-II linac will be capable of producing unprecedented muon beam intensities to support a world-class, variable energy muon user facility at Fermilab, which would be the only one located in the US. R&D towards this future can start in the MTA/ITA facility at the existing 400 MeV Linac, which may be competitive for this physics with PSI. Other low-energy-muon applications can also be studied, including muon spin rotation as applied to superconducting RF resonators for QIS.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

no

Please add details of experiment/project that this abstract corresponds to?

Proposed muonium program at Fermilab Linac and PIP-II; see (inter alia) https://arxiv.org/abs/2212.04897

Primary author: KAPLAN, Daniel (Illinois Institute of Technology)

Co-authors: BOWRING, Daniel (Fermilab); CORRODI, Simon; CRNKOVIC, Jason (Fermilab); GATTO, Corrado (INFN and Northern Illinois University); IZZO, Christopher (Fermilab); JOHNSTONE, Carol (Fermilab); LYNCH, Kevin (Fermilab); MANCINI, Derrick; MAZZACANE, Anna (Fermilab); MCMORRAN, Ben; MILLER, James (Boston University); PHILLIPS, James; PHILLIPS, Thomas (Illinois Institute of Technology); REASENBERG, Robert (UC San Diego); ROBERTS, Thomas; TERRY, Jeff (Illinois Institute of Technology)

Presenter: KAPLAN, Daniel (Illinois Institute of Technology)

Contribution Type: Fermilab open session

Status: ACCEPTED

Submitted by **KAPLAN, Daniel** on **Wednesday, March 15, 2023**

Abstract ID : **76**

WIMPs are Not Dead

Content

Weakly Interacting Massive Particles (WIMPs) that were in thermal equilibrium in the early Universe are one of the most well-motivated particle Dark Matter models. This is in part because WIMP models independently have the same relic abundance of DM as seen by CMB studies. The canonical WIMP mass range is 5 GeV-100 TeV, which we have only just begun to probe. The next generation of DM projects require a suite of experiments that "delves deep, searches wide, and harnesses the complementarity between techniques". I will show how with a diverse portfolio of next generation experiments will allow us to fully cover the thermal WIMP mass range.

Please select if remarks will be in person or on zoom

On zoom

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

Primary author: ALBERT, Andrea (Los Alamos National Lav)

Presenter: ALBERT, Andrea (Los Alamos National Lav)

Contribution Type: Argonne open session

Status: ACCEPTED

Submitted by **ALBERT, Andrea** on **Thursday, March 16, 2023**

Abstract ID : **81**

Novel approaches for neutrino sources

Content

As an organizer of NF09, the Topical Group on Artificial Neutrino Sources, I have seen that, just as modest investment in neutrino detector technology has opened great new opportunities such as DUNE, more investment in new neutrino sources can be game changing. This remark will advocate for the support of small experiments to develop truly novel approaches for neutrino sources. In particular, I will advocate for the next paradigm shift in neutrino beams, in which we bring the accelerator-based neutrino source to the detector, rather than the detector to the accelerator, opening a wide range of unique, pertinent, and highly sensitive BSM physics searches.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

no

Please add details of experiment/project that this abstract corresponds to?

The IsoDAR Experiment

Primary author: SPITZ, Joshua (University of Michigan)

Presenter: SPITZ, Joshua (University of Michigan)

Contribution Type: Fermilab open session

Status: ACCEPTED

Submitted by **SPITZ, Joshua** on **Thursday, March 16, 2023**

Abstract ID : **82**

Hidden sector searches with low-energy neutrino scattering detectors

Content

The Spallation Neutron Source (SNS) at Oak Ridge National Laboratory (ORNL) produces an world-leading intense flux of neutrinos below 53 MeV capable of accumulating an enormous number of protons on target, over 10^23 per year. Beam dump experiments at the SNS are sensitive to hidden sector particles, such as dark matter, produced in the target. Upgrades to the accelerator and construction of a second target station in the coming decade will allow for beam dump experiments at the multi-ton scale.

The COHERENT experiment currently operates a suite of detectors to measure the neutrinos produced at these energy via coherent neutrino-nucleus scattering. Such detectors are well-suited for identifying light dark matter and have made the first search for coherent dark matter-nucleus scattering at a detector. Though this first search involved only 14 kg of active material, the result placed the most stringent limit on 25 MeV dark matter. COHERENT at the SNS will explore the predicted couplings for thermal relic dark matter for scalar and fermion dark matter with a new generation of detectors with nearly 1000x the mass and improvements from the SNS accelerator.

Please select if remarks will be in person or on zoom

On zoom

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

COHERENT

Primary author: PERSHEY, Daniel

Presenter: PERSHEY, Daniel

Contribution Type: Argonne open session

Status: ACCEPTED

Submitted by **PERSHEY, Daniel** on **Thursday, March 16, 2023**

Abstract ID : **84**

Promoting Accelerator Education within the Accelerator complex

Content

The FNAL accelerator complex is under utilized for educating early researchers in particular, students in accelerator physics.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

Primary author: AINSWORTH, Robert (Fermilab)

Presenter: AINSWORTH, Robert (Fermilab)

Contribution Type: Fermilab open session

Status: ACCEPTED

Submitted by **AINSWORTH, Robert** on **Thursday, March 16, 2023**

Abstract ID : **87**

Cosmic Rays and Neutrinos with POEMMA and EUSO-SPB2 — Clinching Space to Open a New Gateway into Fundamental Physics

Content

Ultra-high energy cosmic rays (UHECRs) are the most energetic particles ever detected, reaching energies up to more than ten million times the beam energy of the Large Hadron Collider. Extremely energetic astrophysical sources also produce neutrinos up to very-high energies (VHE). Together, these two messengers offer an unparalleled opportunity to probe the most extreme physics in the Universe, including fundamental physics at energy scales that are far out of reach for terrestrial accelerators. The Probe of Extreme Multi-Messenger Astrophysics (POEMMA) is a proposed space-based experiment for observing fluorescence and optical Cherenkov signals from extensive air showers induced by >~ 20 EeV UHECRs and >~ 20 PeV neutrinos. In going to space, POEMMA will attain a substantial increase in statistics for the highest energy cosmic rays as well as quasi-uniform exposure over the entire celestial sky. POEMMA's design will also feature the capability to rapidly slew in response to transient astrophysical alerts. The upcoming Extreme Universe Space Observatory on a Super Pressure Balloon II (EUSO-SPB2) is a second-generation stratospheric balloon instrument that will serve as a pathfinder mission for space-based observatories such as POEMMA. EUSO-SPB2 is expected to launch from Wanaka, NZ this in Spring 2023. We will discuss the pioneering measurements of POEMMA and EUSO-SPB2 and the promise they offer for accessing fundamental physics.

Please select if remarks will be in person or on zoom

On zoom

Do you describe your self as early career?

no

Please add details of experiment/project that this abstract corresponds to?

POEMMA and EUSO-SPB2

Primary author: VENTERS, Tonia (NASA Goddard Space Flight Center)

Presenter: VENTERS, Tonia (NASA Goddard Space Flight Center)

Contribution Type: Argonne open session

Status: ACCEPTED

Submitted by **VENTERS, Tonia** on **Thursday, March 16, 2023**

Abstract ID : **89**

DUNE Neutrino Event Generators

Content

The DUNE collaboration found that the current theoretical uncertainty on neutrino cross sections and modeling of final states would substantially degrade the sensitivity to CP violation and the mass hierarchy in their measurements. Currently, the uncertainties are estimated to be between 5 and 10%. Disagreements between event generator predictions are even larger. We will discuss the need for the continued development of neutrino event generators and nuclear theory calculations for the success of DUNE.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

DUNE

Primary author: ISAACSON, Joshua (FNAL)

Presenter: ISAACSON, Joshua (FNAL)

Contribution Type: Fermilab open session

Status: ACCEPTED

Submitted by **ISAACSON, Joshua** on **Thursday, March 16, 2023**

Abstract ID : **90**

The Pacific Ocean Neutrino Observatory (P-ONE)

Content

Ten years after its discovery, the production mechanism and sources of the high-energy neutrino background discovered by IceCube and extending to 10 PeV remain almost entirely unknown. Understanding what this first glimpse of the distant, high-energy universe can tell us, a priority of the decadal survey, is currently limited in IceCube by both the total number of detected neutrinos and by angular resolution, which is critical to identify sources. The planned Pacific Ocean Neutrino Observatory (P-ONE) will provide a complementary approach to that taken by IceCube and IceCube-Gen2, focusing on precision measurements and with a view of the sky focusing on the southern hemisphere, where IceCube has its lowest sensitivity but containing the Galactic Center and the fields of view of many next-generation electromagnetic survey telescopes to maximize the potential of cross correlations. Construction of P-ONE by a joint European, Canadian, and US group is scheduled to begin in 2024, leveraging an existing deep-sea research facility in the Pacific Northwest, off the Washington coast, provided by Ocean Networks Canada. When completed, the instrument will provide factor-of-4-to-5 improvements in resolution compared to IceCube, expected to increase the number of known neutrino sources by an order of magnitude, and provide the best performance in complementary areas of the sky to other neutrino telescopes such as IceCube and KM3NeT.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

no

Please add details of experiment/project that this abstract corresponds to?

P-ONE

Primary author: WHITEHORN, Nathan (Michigan State University)

Presenter: WHITEHORN, Nathan (Michigan State University)

Contribution Type: Fermilab open session

Comments:

If necessary, I could present this at ANL, but the FNAL session is strongly preferred for schedule reasons.

Status: ACCEPTED

Submitted by **WHITEHORN, Nathan** on **Thursday, March 16, 2023**

Abstract ID : **95**

Enabling Role of Materials Science in Advancing Particle Physics Technologies

Content

Materials science investigations have delivered critical improvements in particle physics technologies in recent years. By standing up unique capabilities aimed at understanding the role and impact of atomic defects, impurities, surfaces, and interfaces, Fermilab has demonstrated systematic improvements in the performance of technologies such as detectors, accelerators, quantum computers and sensors. For instance, state-of-the-art superconducting radiofrequency cavities for accelerator applications have been prepared through detailed investigations of heat treatments, while superconducting qubits that represent the leading edge in terms of coherence have been fabricated through a robust understanding of dissipation mechanisms on the atomic scale. I strongly advocate for continued and increased support of materials science projects in this realm as they will be essential for continued advancement of particle physics technologies over the next decade.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

This work is in the context of SRF, magnet, and quantum technology as part of APS-TD and SQMS

Primary author: MURTHY, Akshay (Fermi National Accelerator Laboratory)

Presenter: MURTHY, Akshay (Fermi National Accelerator Laboratory)

Contribution Type: Fermilab open session

Status: ACCEPTED

Submitted by **MURTHY, Akshay** on **Thursday, March 16, 2023**

Abstract ID : **97**

Theia Physics Program

Content

Theia is a proposed many-ktonne scale “hybrid” optical neutrino detector with the potential for a broad physics program. Hybrid detectors leverage advancing technology in fast-timing photon sensors, chromatic photon sorting, and new scintillating materials, such as water-based liquid scintillator, in order to simultaneously distinguish both the Cherenkov and scintillation signals. Using the scintillation light, Theia can achieve excellent vertex and energy reconstruction and sub-Cherenkov thresholds, while the ring imaging from the Cherenkov signal provides directionality and enhanced particle identification. This technology enables a broad physics program including world-class measurements of low- and high-energy solar neutrinos, sensitive searches for nucleon decay, observation of the diffuse supernova background, a sensitive probe of geo and reactor neutrinos, and ultimately a search for neutrinoless double beta decay. Theia can provide a complementary measurement, using a low-Z target material, of δ_{cp} and the neutrino mass ordering if deployed as a far detector module as part of Phase II of DUNE. Overall, Theia provides a uniquely broad program and presents an exciting opportunity for the future of neutrino physics.

Please select if remarks will be in person or on zoom

On zoom

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

Theia

Primary author: KAPTANOGLU, Tanner (UC Berkeley)

Presenter: KAPTANOGLU, Tanner (UC Berkeley)

Contribution Type: Fermilab open session

Status: ACCEPTED

Submitted by **KAPTANOGLU, Tanner** on **Thursday, March 16, 2023**

Abstract ID : **98**

Trinity: UHE Earth-skimming Neutrino Detector

Content

Trinity is a next-generation imaging air Cherenkov telescope array that utilizes an earth-skimming technique to detect Ultra-High-Energy (UHE) neutrinos. Its sensitivity will play a crucial role in filling the gap between the observed astrophysical neutrinos observed by IceCube and the predicted sensitivity of radio UHE neutrinos detectors. As proof of the concept, we are building a smaller demonstrator telescope in Milford, Utah. I will show the progress on bringing the Trinity demonstrator online and talk about how it fits into our plans for the full Trinity array.

Please select if remarks will be in person or on zoom

On zoom

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

Primary author: POTTS, Mathew (GA Tech)

Presenter: POTTS, Mathew (GA Tech)

Contribution Type: Argonne open session

Status: ACCEPTED

Submitted by **POTTS, Mathew** on **Thursday, March 16, 2023**

Abstract ID : **100**

Neutrino Opportunities at a Muon Collider

Content

Muon decay is a well understood, equal numbers of electron/muon (anti)neutrinos and muon neutrinos with precisely known energy spectra. Also, with Very high luminosity for both muon and electron flavor content, Well known neutrino energy spectra, as well as very well determined beam intensity. These all make a muon colliders an ideal place to investigate rare or new neutrino interactions. I will briefly remark some of these opportunities that a muon collider can provide. These include (but are not limited to) i) precision in neutrino Cross Section Measurements at TeV energy ranges; ii) precision in Weak Mixing Angle; iii) Indirect BSM Searches (SMEFT) related to 4-fermion interactions that include neutrinos; iv) Direct searches of new physics related to neutrinos.

Please select if remarks will be in person or on zoom

On zoom

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

Muon Collider

Primary author: TABRIZI, Zahra (Northwestern University)

Presenter: TABRIZI, Zahra (Northwestern University)

Contribution Type: Argonne open session

Comments:

It will be based on the invited talk prepared for the recent KITP Program: Muon Collider Workshop: https://online.kitp.ucsb.edu/online/muoncollider-m23/tabrizi/

Status: ACCEPTED

Submitted by **TABRIZI, Zahra** on **Thursday, March 16, 2023**

Abstract ID : **102**

Long Term Potential of the Modern Modular Bubble Chamber

Content

Long-baseline neutrino oscillation experiments present some of the most compelling paths towards beyond-the-standard-model physics through measurement of PMNS matrix elements and observation of the degree of leptonic CP violation. Due to their world leading intensity, the next generation of oscillation experiments, DUNE and Hyper-K, also present an opportunity for novel measurements that are simultaneously orthogonal paths to BSM physics and complementary to the projected offerings of the upcoming Electron-Ion Collider. A quick survey of relevant topics include a measurement of the Weinberg angle and W-Mass; precision probes of nucleon quark content, opening a path to novel form factors; the investigation of nuclear modification with special regard to the axial currents; possible contributions to the proton spin-puzzle through nucleon tomography; and the importance of generalized parton distribution functions. These comments will review the contribution of a hydrogen bubble chamber to the DUNE physics program as well as lay out a long term physics program for this device.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

Modern Modular Bubble Chamber

Primary author: RAMSON, Bryan

Presenter: RAMSON, Bryan

Contribution Type: Fermilab open session

Status: ACCEPTED

Submitted by **RAMSON, Bryan** on **Thursday, March 16, 2023**

Abstract ID : **103**

Dedicated R&D Facilities for Frontier Research in Accelerator Science and Technology

Content

The Snowmass Process has highlighted the importance of understanding the technical feasibility and performance of future discovery-science accelerator facilities. Frontier research in Accelerator Science and Technology (AST) is essential to this understanding. The nature of this research is generally incompatible with user facilities, which are inflexible and highly subscribed, and instead demands the availability of dedicated AST R&D facilities. As we consider the near-term priorities and long-term horizon of high-energy physics, it is important to ensure that the available AST infrastructure and expertise will be well aligned with the community's consensus. As an example, we briefly describe one such dedicated R&D facility that has been developed over the last decade: the Fermilab Accelerator Science and Technology (FAST) Facility.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

Primary author: JARVIS, Jonathan (Fermilab)

Presenter: JARVIS, Jonathan (Fermilab)

Contribution Type: Fermilab open session

Status: ACCEPTED

Submitted by **JARVIS, Jonathan** on **Thursday, March 16, 2023**

Abstract ID : **104**

The Importance of Small Experiments for the Vitality of Neutrino Physics

Content

A balanced portfolio of experiments across all scales is important for the vitality of Neutrino Physics as a whole. Here, we describe some important features of small experiments and the challenges they face. The scale of small experiments provides the ability to react nimbly to emerging opportunities for scientific discovery and to leverage existing equipment and infrastructure at Universities and Laboratories. Small experiments allow early career community members to participate in the full experimental lifecycle, from conception through scientific analysis, providing a unique training ground for well-rounded generalists and a wealth of leadership opportunities. But, it can be challenging for small experiments to gain visibility and secure the resources they need to succeed. We encourage the community to develop strategies that ensure both resource and logistical support for small experiments, due to the critical role they play in advancing the science of our field and developing the skilled and diverse workforce that we need.

Please select if remarks will be in person or on zoom

On zoom

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

Primary author: ROCA, Cristian (LLNL)

Presenter: ROCA, Cristian (LLNL)

Contribution Type: Argonne open session

Status: ACCEPTED

Submitted by **ROCA, Cristian** on **Thursday, March 16, 2023**

Abstract ID : **110**

Particle Physics Beyond-the-Standard-Model with Cosmic Accelerators

Content

High-energy gamma-ray observations have the potential to probe fundamental physics at energy scales and distances not accessible to earthbound accelerators. With the long distances to astrophysical sources, TeV gamma-ray observations can constrain violations of Lorentz Invariance to beyond the Planck scale. Axion-like particles can be produced in the magnetic fields surrounding astrophysical objects and modify their high-energy spectra. With TeV gamma-ray observations, we can push our understanding of particle physics processes, including those beyond the Standard Model, into regimes that cannot be reached on earth. With several upcoming experiments able to push our observations of cosmic gamma rays to the hundreds of TeV and PeV energies, now is the time to push our understanding of these processes into the unknown.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

no

Please add details of experiment/project that this abstract corresponds to?

SWGO, CTA

Primary author: HARDING, J. Patrick (Los Alamos National Laboratory)

Presenter: HARDING, J. Patrick (Los Alamos National Laboratory)

Contribution Type: Fermilab open session

Status: ACCEPTED

Submitted by **HARDING, J. Patrick** on **Friday, March 17, 2023**

Abstract ID : **111**

Support for an National Axion User Facility

Content

Dark matter makes up 85% of the matter in the universe and 27% of its energy density, but we don't know what comprises dark matter. Wavelike dark matter, including the QCD axion, are well-motivated dark matter candidates that have been receiving more attention in recent years. However, if the axion exists, its mass is unknown, requiring experiments to search through a broad range of parameter space. Yet only a small fraction of the viable parameter space has been ruled out by experiments. The community yearns for enabling technologies that will make the rest of the axion parameter space more accessible. An axion user facility would catalyze the R&D required to develop these enabling technologies and test different axion detection methods. Axion searches often require large magnets, milliKelvin cryogenics, and sophisticated quantum sensors. An axion user facility would allow the community to share engineering and infrastructure resources, leading to a larger and more efficient axion discovery program.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

I am a part of SQMS/Fermilab, but I am advocating for all wavelike dark matter experiments including ADMX, DM Radio, and HAYSTAC.

Primary author: CERVANTES, Raphael (Fermilab)

Presenter: CERVANTES, Raphael (Fermilab)

Contribution Type: Fermilab open session

Status: ACCEPTED

Submitted by **CERVANTES, Raphael** on **Friday, March 17, 2023**

Abstract ID : **112**

Future Physics Opportunities at the Oak Ridge National Laboratory Spallation Neutron Source

Content

The Oak Ridge National Laboratory (ORNL) Spallation Neutron Source (SNS) First Target Station (FTS), used by the COHERENT experiment, provides an intense and extremely high-quality source of pulsed stopped-pion neutrinos, with energies up to about 50~MeV. Upgrades to the SNS are underway, including a Second Target Station (STS) in the early 2030's, which will approximately double the source power while maintaining neutrino spectral quality similar to the FTS source. Furthermore, additional space for ten-tonne scale detectors may be available.
We highlight exciting opportunities for neutrino physics, other particle and nuclear physics, as well as detector development, for the FTS and STS neutrino sources in the next decade.

Please select if remarks will be in person or on zoom

On zoom

Do you describe your self as early career?

no

Please add details of experiment/project that this abstract corresponds to?

COHERENT

Primary authors: NEWBY, Jason (Oak Ridge National Laboratory); PERSHEY, Daniel; RAPP, Rebecca (Carnegie Mellon University); TSAI, Yun-Tse (SLAC)

Presenter: NEWBY, Jason (Oak Ridge National Laboratory)

Contribution Type: Argonne open session

Status: ACCEPTED

Submitted by **NEWBY, Jason** on **Friday, March 17, 2023**

Abstract ID : **113**

Neutrino Physics and R&D at ANNIE

Content

The Accelerator Neutrino Neutron Interaction Experiment (ANNIE) is a 26-ton gadolinium-loaded water Cherenkov neutrino detector located in the Fermilab Booster Neutrino Beam. The experiment is performing a suite of targeted neutrino-nucleus interaction measurements while also serving as an R&D testbed for the future large-scale neutrino program. Ongoing measurements include characterization of neutrino-induced neutron production and backgrounds for DSNB and proton decay searches, and joint measurements with LArTPCs located in the same beamline to extract precision water/argon cross section ratios and improve nuclear modeling. The R&D program has included deployment of a Gd-loaded water target, Large-Area Picosecond Photodetectors (LAPPDs), and novel water-based liquid scintillator (WbLS) targets, all highly relevant to the future program. As a smaller experiment and collaboration, ANNIE can provide high-impact measurements and a flexible testbed for the evolving needs of the community, along with outstanding opportunities for holistic training of early career scientists. On account of these benefits, it is imperative that experiments of this scale receive robust and predictable support in the coming years.

Please select if remarks will be in person or on zoom

On zoom

Do you describe your self as early career?

Please add details of experiment/project that this abstract corresponds to?

ANNIE

Primary author: MASTBAUM, Andrew (Rutgers University)

Presenter: MASTBAUM, Andrew (Rutgers University)

Contribution Type: Argonne open session

Status: ACCEPTED

Submitted by **MASTBAUM, Andrew** on **Friday, March 17, 2023**

Abstract ID : **114**

Whole-PhD Support for Students in Instrumentation

Content

There is growing recognition that training the next generation of instrumentation experts is vital to the future of HEP. Unfortunately, most student support mechanisms in instrumentation, including SCGSR and Traineeship programs, take a "one and done" approach – one year of support in instrumentation after which a student returns to their regularly scheduled PhD. This is in stark contrast to the experiences of the current leaders and rising stars in neutrino, rare process, dark matter and QIS physics, many of whom enjoyed graduate experiences where instrumentation was not a 1-year add-on, but rather an organic part of an entire PhD, often on a small pathfinder experiment. To support such a PhD today is exceedingly challenging, typically requiring a half-dozen different funding sources per student over the course of their PhD. Mechanisms for whole-PhD support – which could be adapted from existing instrumentation programs supporting students at labs and at universities – are needed to cultivate the innovators that will drive HEP forward.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

no

Please add details of experiment/project that this abstract corresponds to?

Primary author: Prof. DAHL, Eric (Northwestern University / Fermilab)

Presenter: Prof. DAHL, Eric (Northwestern University / Fermilab)

Contribution Type: Fermilab open session

Status: ACCEPTED

Submitted by **Prof. DAHL, Eric** on **Friday, March 17, 2023**

Abstract ID : **116**

CTA and IceCube: the prospects of multi-messenger astrophysics with next-generation gamma-ray and neutrino observatories

Content

In the last decade, IceCube has enabled multi-messenger astronomy with neutrinos and revolutionized the field of astroparticle physics. By combining gamma-ray and neutrino data, significant progress has been made in understanding the most energetic phenomena in the universe. However, there is still much to be explored and understood. As the next-generation instruments for both messengers, such as the Cherenkov Telescope Array (CTA) and IceCube-Gen2, are on the horizon, it is crucial to consider the prospects and strategies for multi-messenger science. The upcoming era of IceCube-CTA synergy holds great potential for advancing our understanding of the universe.

Please select if remarks will be in person or on zoom

On zoom

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

The CTA SCT Project

Primary authors: FENG, Qi (SAO); THE CTA SCT PROJECT

Presenter: FENG, Qi (SAO)

Contribution Type: Argonne open session

Status: ACCEPTED

Submitted by **FENG, Qi** on **Friday, March 17, 2023**

Abstract ID : **117**

The Feasibility of In-Ice Ultrahigh Energy Neutrino Detectors

Content

Substantial progress has been made in the last decade in the development of in-ice neutrino detectors targeting 10 PeV and above. In particular, the Askaryan Radio Array at the South Pole has pioneered a low-threshold trigger that is simple to deploy, computationally inexpensive to analyze, and substantially more efficient. This design is scalable for both medium-scale (RNO-G) and large-scale (IceCube Gen2-Radio) projects, and is ready to be deployed in the next generation of in-ice UHE neutrino experiments.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

IceCube-Gen2, Askaryan Radio Array

Primary author: HUGHES, Kaeli (The University of Chicago)

Presenter: HUGHES, Kaeli (The University of Chicago)

Contribution Type: Argonne open session

Status: ACCEPTED

Submitted by **Dr HUGHES, Kaeli** on **Friday, March 17, 2023**

Abstract ID : **118**

Particle Physics with Ultrahigh-Energy Neutrinos

Content

Recent discoveries in the last decade have shown that cosmic neutrinos present a robust method for pursuing open particle physics questions in the weak scale. A neutrino beam is expected from cosmic sources at ultrahigh-energies that can probe energies otherwise inaccessible with experiments here on Earth. In these remarks, we will comment on the exciting opportunities available at energies neutrino energy (>PeV) that will be made accessible through experiments in the coming decade.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

no

Please add details of experiment/project that this abstract corresponds to?

IceCube-Gen2

Primary author: WISSEL, Stephanie (Pennsylvania State University)

Presenter: WISSEL, Stephanie (Pennsylvania State University)

Contribution Type: Argonne open session

Status: ACCEPTED

Submitted by **WISSEL, Stephanie** on **Friday, March 17, 2023**

Abstract ID : **120**

SRF cavity-based searches for new physics

Content

Superconducting radio frequency (SRF) cavities are fundamental components of particle accelerators, but their uses extend beyond the accelerator field. Extensive R&D on SRF cavities has enabled to achieve ultra-high quality factors, opening the doors for new applications, such as quantum information science and searches for new fundamental physics. The Superconducting Quantum Materials and Systems Center is leading the effort on this front with a focus area dedicated to quantum physics and sensing.
Support from HEP to the quantum field allowed to strengthen this research line through small-scale experiments searching for dark matter candidates, new particles, and gravitational waves. Continued support from HEP may enable to multiply the efforts and also grow the most promising smaller searches into larger experiments that leverage Fermilab leading expertise in SRF cavities and the quantum technology progress brought forward by the QIS field.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

Primary author: GIACCONE, Bianca

Presenter: GIACCONE, Bianca

Contribution Type: Fermilab open session

Status: ACCEPTED

Submitted by **GIACCONE, Bianca** on **Friday, March 17, 2023**

Abstract ID : **121**

The PROSPECT reactor neutrino experiment: Highlights and future opportunities

Content

The PROSPECT experiment is a small project success story from the last P5/Snowmass cycle. A first-generation detector called PROSPECT-I, located on the Earth's surface roughly 7 m from the 85 MW, compact, highly-enriched High Flux Isotope Reactor (HFIR) at Oak Ridge National Laboratory, took data in 2018 and 2019. The results obtained from this experimental campaign have been of significant scientific impact by placing stringent limits on short baseline neutrino oscillations at the eV scale, setting new direct limits on boosted dark matter models, and providing a precision U spectral measurement, all while providing excellent professional development opportunities for young scientists. Following the success of PROSPECT-I, the collaboration is now preparing for its second phase, called PROSPECT-II. With an upgraded detector design, PROSPECT-II will allow us to expand beyond the current analyses, with improved sensitivity and statistics providing unique inputs to the U.S. neutrino frontier.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

PROSPECT

Primary author: VENEGAS VARGAS, Diego (University of Tennessee Knox/ Oak Ridge National Laboratory)

Presenter: VENEGAS VARGAS, Diego (University of Tennessee Knox/ Oak Ridge National Laboratory)

Contribution Type: Argonne open session

Status: ACCEPTED

Submitted by **VENEGAS VARGAS, Diego** on **Friday, March 17, 2023**

Abstract ID : **122**

CYGNUS: New Physics Capabilities from Recoil Imaging

Content

A Snowmass working group of 167 experimental and theoretical physicists straddling the neutrino, cosmic, and instrumentation frontiers started to map out the physics case for a modular, low-energy, "recoil imaging" experiment, which we call CYGNUS.

The ultimate goal is to build a large detector that can count and localize — in the optimal case — individual electrons of ionization in a very large volume of gas. This uniquely enables the topological and directional reconstruction of nuclear and electronic recoils, and much more. We have a proposal for a 30+-year program of experiments where the technology is fully optimized while gradually scaling up the size of detectors.

A portfolio of gas-target detectors would strongly complement ongoing solid-state-based experiments yet are under-represented in the US program. While gas-target detectors have comparatively low target density, the consequently large detector volume and room-temperature operation result in operational advantages and unique physics reach. Three very broad and general examples are 1) detection of complex, multi-particle final states that cannot be resolved in other detectors 2) detection of BSM physics models where the sensitivity scales with detector volume, rather than mass, and 3) low-energy neutrino spectroscopy.

For every factor of ten increase in detector volume, interesting new measurements become possible. Liter-scale gas detectors are already being constructed to measure the Migdal effect, which other experiments implicitly rely on, but cannot probe. Cubic-meter scale detectors could be used to demonstrate directional sensitivity to Coherent Elastic Neutrino-Nucleus Scattering (CEνNS), for example at the Spallation Neutron Source (SNS) at Oak Ridge National Lab, and to search for BSM mediator particles contributing to the neutral-current interaction. Detectors at this scale could also search for low-mass dark matter, heavy sterile neutrinos, and axion-like particles. 10-m^3-scale detectors could produce the strongest spin-dependent WIMP-proton cross section limits of any experiment across all WIMP masses. 1000-m^3-scale detectors could perform solar neutrino physics. Larger volumes would bring sensitivity to neutrinos from an even wider range of sources, including galactic supernovae, nuclear reactors, and geological processes. An ambitious DUNE-scale detector, but operating at room temperature and atmospheric pressure, could have non-directional WIMP sensitivity in excess of any proposed experiment, and use directionality to penetrate deep into the neutrino floor.

Finally, if a dark matter signal is observed, this would mark the beginning of a new era in physics. A large directional detector as envisioned here would then hold the key to first establishing the galactic origin of the signal, and to subsequently map the local WIMP velocity distribution and explore the particle phenomenology of dark matter.

For further information, see https://arxiv.org/abs/2203.05914

Please select if remarks will be in person or on zoom

On zoom

Do you describe your self as early career?

no

Please add details of experiment/project that this abstract corresponds to?

CYGNUS experiment

Primary author: VAHSEN, Sven (University of Hawaii)

Presenter: VAHSEN, Sven (University of Hawaii)

Contribution Type: Argonne open session

Comments:

for the CYGNUS collaboration

Status: ACCEPTED

Submitted by **VAHSEN, Sven** on **Friday, March 17, 2023**

Abstract ID : **123**

Advanced Accelerator Concepts for Future Colliders

Content

Advanced accelerator concepts (AAC) hold tremendous promise for enabling future precision energy-frontier machines. With their demonstrated ultra-high acceleration gradients, well beyond those of conventional klystron-powered accelerators, AAC technologies have the potential to revolutionize the field by enabling the development of more compact and cost-effective future colliders, while reducing power consumption and environmental impact. AAC technologies, including wakefield acceleration in either plasmas or structures, driven by either charged particle beams or laser pulses, have seen rapid progress in recent years. One promising AAC approach is the structure-based wakefield acceleration (SWFA), which has been extensively studied at the Argonne Wakefield Accelerator (AWA) facility at ANL. In this talk, I will present our vision within the AAC community regarding the R&D Roadmap aimed at developing an AAC-based collider, with an emphasis on the SWFA approach.
For those that are here for this townhall, you are invited to tour the AWA facility and learn more about our AAC-related activities.

Please select if remarks will be in person or on zoom

In person

Do you describe your self as early career?

yes

Please add details of experiment/project that this abstract corresponds to?

Primary author: LU, Xueying (Northern Illinois Univ / Argonne National Laboratory)

Presenter: LU, Xueying (Northern Illinois Univ / Argonne National Laboratory)

Contribution Type: Argonne open session

Status: ACCEPTED

Submitted by **LU, Xueying** on **Friday, March 17, 2023**