P5 Town Hall at LBNL

Report of Contributions

https://indico.physics.lbl.gov/e/2382

Contribution ID: **1** Type: **not specified**

P5 process

Wednesday, 22 February 2023 08:35 (20 minutes)

Presenter: MURAYAMA, Hitoshi

Session Classification: Introduction

Contribution ID: **2** Type: **not specified**

Astro 2020 (zoom)

Wednesday, 22 February 2023 09:00 (20 minutes)

Presenter: HARRISON, Fiona (Caltech)

Session Classification: Introduction

Contribution ID: **3** Type: **not specified**

EPP 2024

Wednesday, 22 February 2023 09:20 (20 minutes)

Presenters: SPIROPULU, Maria (Caltech); TURNER, Michael (Chicago)

Session Classification: Introduction

Contribution ID: **4** Type: **not specified**

overview including Astrophysical probes

Wednesday, 22 February 2023 09:40 (25 minutes)

Presenter: LISANTI, Mariangela (Princeton)

Session Classification: Dark Matter

Contribution ID: **5** Type: **not specified**

noble gas-based direct detection & G3

Wednesday, 22 February 2023 10:05 (30 minutes)

Presenter: AKERIB, Dan (SLAC)

Session Classification: Dark Matter

Contribution ID: **6** Type: **not specified**

Solid-state based direct detection & G3

Wednesday, 22 February 2023 11:05 (30 minutes)

Presenter: PYLE, Matt (UC Berkeley)

Session Classification: Dark Matter

Contribution ID: **7** Type: **not specified**

Axion direct detection (haloscope & helioscope) & G3

Wednesday, 22 February 2023 11:35 (30 minutes)

Presenter: RYBKA, Gary (UW Seattle)

Session Classification: Dark Matter

Contribution ID: **8** Type: **not specified**

Emerging concepts

Wednesday, 22 February 2023 12:05 (20 minutes)

Presenter: LIN, Tongyan

Session Classification: Dark Matter

Contribution ID: **9** Type: **not specified**

overview

Wednesday, 22 February 2023 13:45 (30 minutes)

Presenter: KRAUSE, Elisabeth (Arizona)

Session Classification: Dark Energy

Contribution ID: **10** Type: **not specified**

Rubin and extension

Wednesday, 22 February 2023 14:15 (25 minutes)

Presenter: STUBBS, Chris

Session Classification: Dark Energy

Contribution ID: **11** Type: **not specified**

DESI + DESI-II

Wednesday, 22 February 2023 14:40 (25 minutes)

Presenter: DAWSON, Kyle (Utah)

Session Classification: Dark Energy

Contribution ID: **12** Type: **not specified**

Stage V

Wednesday, 22 February 2023 15:05 (25 minutes)

Presenter: SCHLEGEL, David

Session Classification: Dark Energy

Contribution ID: **13** Type: **not specified**

AI/ML

Wednesday, 22 February 2023 16:00 (15 minutes)

Presenter: NACHMAN, Ben

Session Classification: National Initiatives

Contribution ID: **14** Type: **not specified**

QIS

Wednesday, 22 February 2023 16:15 (15 minutes)

Presenter: GARCIA-SCIVERES, Maurice (LBNL)

Session Classification: National Initiatives

Contribution ID: **15** Type: **not specified**

microelectronics

Wednesday, 22 February 2023 16:30 (15 minutes)

Presenter: DRAGONE, Angelo (SLAC)

Session Classification: National Initiatives

Contribution ID: **16** Type: **not specified**

DEI

Wednesday, 22 February 2023 16:45 (20 minutes)

Presenter: ERBACHER, Robin (UC Davis)

Session Classification: National Initiatives

Contribution ID: **17** Type: **not specified**

Snowmass Cosmic Frontier

Thursday, 23 February 2023 08:30 (30 minutes)

Presenter: TAIT, Tim

Session Classification: Reports

Contribution ID: **18** Type: **not specified**

APPEC (zoom)

Thursday, 23 February 2023 09:00 (20 minutes)

Presenter: HAUNGS, Andreas (Karlsruhe Institute of Technology)

Session Classification: Reports

Contribution ID: **19** Type: **not specified**

overview (zoom)

Thursday, 23 February 2023 09:20 (20 minutes)

Presenter: GREEN, Dan (UC San Diego)

Session Classification: CMB

Contribution ID: **20** Type: **not specified**

Simons Observatory

Thursday, 23 February 2023 09:40 (15 minutes)

Presenter: LEE, Adrian

Session Classification: CMB

Contribution ID: **21** Type: **not specified**

SPT + BICEP

Thursday, 23 February 2023 09:55 (15 minutes)

Presenter: BENSON, Brad (Chicago)

Session Classification: CMB

Contribution ID: **22** Type: **not specified**

constraints at the South Pole

Presenter: SHARP, Nigel (NSF)

Session Classification: CMB

Contribution ID: **23** Type: **not specified**

CMB-S4

Thursday, 23 February 2023 10:40 (35 minutes)

Presenters: MCMAHON, Jeff (Chicago); STRAIT, Jim (LBNL)

Session Classification: CMB

Contribution ID: **24** Type: **not specified**

Space Missions

Thursday, 23 February 2023 11:15 (20 minutes)

Presenter: HAZUMI, Masashi (KEK)

Session Classification: CMB

Contribution ID: **25** Type: **not specified**

Line Intensity Mapping

Thursday, 23 February 2023 11:35 (20 minutes)

Presenter: NEWBURGH, Laura

Session Classification: New Opportunities

Contribution ID: **26** Type: **not specified**

Commercial Lunar Payload Services (zoom)

Thursday, 23 February 2023 11:55 (15 minutes)

Presenter: SLOSAR, Anže (Brookhaven)

Session Classification: New Opportunities

Contribution ID: **27** Type: **not specified**

Welcome to LBNL

Wednesday, 22 February 2023 08:55 (5 minutes)

Presenter: WITHERELL, Mike

Session Classification: Introduction

Contribution ID: **28** Type: **not specified**

Logistics

Wednesday, 22 February 2023 08:30 (5 minutes)

Presenter: SPADAFORA, Anthony

Session Classification: Introduction

Contribution ID: **36** Type: **Early Career Scientist**

Reflections on DESI construction from early career scientists

Thursday, 23 February 2023 15:10 (5 minutes)

The Dark Energy Spectroscopic Instrument provided many opportunities for early career scientists to involve themselves with the construction and commissioning on the instrument. Much of my training as a scientist has been through working on DESI construction, commissioning and early analysis of data. Following the development of a project in one's early career is a unique and formative experience. Similar opportunities for early career scientists to involve themselves with developing projects should continue to be cultivated within the community for future projects.

Primary author: FANNING, Kevin (Ohio State University)

Presenter: POPPETT, Claire (UC Berkeley, Space Sciences Lab)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **38** Type: **Early Career Scientist**

Science from high density galaxy samples with DESI-II

Thursday, 23 February 2023 14:05 (5 minutes)

DESI is pushing the boundaries in terms of the depth and number of spectroscopic redshifts being collected. The ambitious DESI-II and Spec5 programs will collect even larger samples of deep spectra for intermediate-mass galaxies at $z < 1$. These samples will greatly serve to improve our understanding of the connection between galaxies and dark matter at $z < 1$. I will discuss how this understanding will be critical for characterizing some of the most important systematics that will be relevant in the LSST era, including the effects of baryons on the matter distribution, and intrinsic alignments.

Primary author: Dr HEYDENREICH, Sven (UCSC)

Co-authors: Prof. LEAUTHAUD, Alexie (UCSC); XHAKAJ, Enia (UCSC)

Presenter: Dr HEYDENREICH, Sven (UCSC)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **40** Type: **not specified**

(zoom) DESI: A Successful University –National Laboratory Partnership

Thursday, 23 February 2023 16:00 (5 minutes)

Recommended by the last P5 committee, construction of the Dark Energy Spectroscopic Instrument (DESI) began in 2014. Led by Lawrence Berkeley National Lab, major components of the new instrument were developed and built by university groups both in the US and in Europe.

The spectrograph mechanisms, the commissioning instrument and the instrument control and monitoring system were developed and built at Ohio State University, all 5,000 (plus spares) fiber positioning robots and the associated electronics were assembled at the University of Michigan, development and assembly of the new wide field corrector was led by University College of London in partnership with Fermi National Accelerator Lab, Durham University built the fiber cables, a consortium of Spanish universities and institutes developed the guide and alignment cameras, the University of Arizona developed the blue CCDs and the sky monitor system was provided by the University of California, Irvine. Instrument commissioning was led by the University of California, Santa Cruz.

DESI construction ended in 2019 and survey operations started in May 2021. Completing construction of an instrument as complicated as DESI on schedule is a clear success of this strong partnership between national labs and universities. Equally important is the support this partnership provides for critical infrastructure at the universities. Technical infrastructure at universities has been in decline for decades. Constructing major components of DESI at universities not only helped to reverse this trend but it also engaged and trained many early career scientists. We are looking forward to continuing these successful partnerships with DESI-II and eventually SPEC S5.

Primary authors: Prof. HONSCHEID, Klaus (Ohio State University); Prof. MARTINI, Paul (Ohio State University)

Presenters: Prof. HONSCHEID, Klaus (Ohio State University); Prof. MARTINI, Paul (Ohio State University)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **42** Type: **not specified**

Cosmic Probes of Dark Matter Physics

Thursday, 23 February 2023 14:00 (5 minutes)

Cosmological and astrophysical observations currently provide the only robust, positive empirical evidence for the existence of dark matter. Furthermore, cosmic probes of dark matter, which seek to determine the fundamental properties of dark matter through observations of the cosmos, have emerged as a promising means to reveal the nature of dark matter. Cosmic survey projects provide a unique avenue to understand the properties of dark matter as part of a comprehensive experimental dark matter program that spans the frontiers of high energy physics. The study of dark matter with cosmic observations should be considered a core component of the scientific program of cosmic survey projects in the decade to come.

Primary author: DRLICA-WAGNER, Alex

Presenters: DRLICA-WAGNER, Alex; PETER, Annika (The Ohio State University); NADLER, Ethan (Carnegie Observatories & USC)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **43** Type: **not specified**

(zoom) Fifteen years of fruitful collaboration between French and DOE labs in cosmology

Thursday, 23 February 2023 14:25 (5 minutes)

For the past 15 years at least, French labs (CEA-Saclay, INSU/IPA, INSU/LAM, IN2P3/LPNHE and IN2P3/CPPM) have successfully collaborated with DOE labs on wide-field spectroscopic surveys (BOSS, eBOSS, DESI). These contributions cover all the range from construction of the instrument to survey design and later data analysis. In BOSS/eBOSS, the French teams provided their expertise on the selection of the sources to target, and initiated the study of baryonic oscillations at the highest redshifts (the so-called Lyman-alpha forest data). In DESI, the French groups expanded their contribution and also played a major role in the design and construction of the 10 spectrographs. Based on this fruitful experience, the French Labs are interested in contributing to DESI-II and to a stage-5 spectroscopic survey.

Primary author: Mr YÈCHE, Christophe (CEA-Saclay Irfu)

Presenter: Mr YÈCHE, Christophe (CEA-Saclay Irfu)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **45** Type: **Early Career Scientist**

(zoom) Significance of Simulation Capability Readiness for the Next Era of Cosmic Frontier Science

Thursday, 23 February 2023 16:20 (5 minutes)

Simulations have been and continue to play a crucial role in cosmic frontier surveys. As we explore further into uncharted science with increasingly precise measurements, the need for accurate theoretical predictions and cross-correlation measurements will only rise. The simulation challenges of the next decade involve not only enhancing physics modeling fidelity, but also the ability to fully utilize new generations of computing facilities for science. The ongoing efforts and successes of the Exascale Computing Project are a crucial example of the vital and demanding requirements of scientific codes to effectively use modern supercomputing hardware. Over time, we can anticipate that the difficulties to use machines beyond exascale will grow, thus emphasizing the need for supporting simulation development to address this issue.

Primary author: Dr FRONTIERE, Nicholas (Argonne National Laboratory)

Presenter: Dr FRONTIERE, Nicholas (Argonne National Laboratory)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **47** Type: **not specified**

(zoom) The Need for R&D Towards a Stage 5 CMB Facility

Thursday, 23 February 2023 16:10 (5 minutes)

CMB experiments have contributed powerful constraints on the fundamental physics of the Universe. Upcoming CMB experiments such as the Simons Observatory and CMB-S4 are poised to extend this progress even further. However, CMB experiments still have a wealth of information to offer beyond these near-term facilities regarding the properties of dark matter, inflation, light relic particles, and dark energy. In particular, a much lower-noise and higher-resolution wide-area CMB survey can cross a number of critical fundamental physics thresholds and open a relatively untapped window of late-time CMB anisotropies. The Snowmass Cosmic Frontier Report said we need to "Support R&D and pathfinder studies for a next-generation CMB experiment (at the Stage V or VI level)", and "Support R&D and small projects to develop technologies and methods that can enable future surveys (e.g., LIM and CMB-S5)". It is essential to support R&D this decade, on both the theory and instrumental fronts, to enable a future Stage 5 CMB facility and the wealth of discoveries it can provide.

Primary author: Prof. SEHGAL, Neelima (Stony Brook University)

Presenter: Prof. SEHGAL, Neelima (Stony Brook University)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **48** Type: **Early Career Scientist**

Building on the successes of the Dark Energy Specroscopic Instument (DESI)

The Dark Energy Spectroscopic Instrument is the most powerful redshift survey instrument ever built because of the significant early investment in R&D. During this period, we optimized every design decision resulting in the largest and most stable fiber system in the history of surveys for astrophysics. I joined the DESI project as a postdoc who was passionate about finding technological solutions that enabled new science, and later became a research physicist at UC Berkeley Space Sciences Laboratory. I personally designed and built the fiber system and oversaw the grating system that allow our spectrographs to be optimized across every wavelength band, ultimately becoming Lead Fiber Scientist (an L2 manager position), a Lead Observer, and DESI manager for nighttime operations (an L2 manager position). I strongly believe that the future of Cosmology relies on training and retaining instrument builders like me who rely on the prospect of future world-class survey instruments. In this presentation I will present the research that led to the success of DESI, and the role it plays in the path to stage V science.

Primary author: Dr POPPETT, claire (UCB)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **49** Type: **not specified**

(zoom) Training the Next Generation of Physicists and Engineers at Universities

Thursday, 23 February 2023 14:10 (5 minutes)

Workforce development remains a high priority for the DoE High Energy Physics program. Scientists and engineers who currently participate in DoE projects were often introduced to research as undergraduates at our Universities. Preserving a strong and continuous human and facilities infrastructure at our nation's universities is essential to maintaining an effective and sustainable program into the foreseeable future. The author will describe a program that he led at the University of Michigan that produced more than 7000 fiber positioning robots for the Dark Energy Spectroscopic Instrument involving over two dozen undergraduates in all aspects of scientific research.

Primary author: TARLE, Gregory (University of Michigan)

Presenter: TARLE, Gregory (University of Michigan)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **51** Type: **Early Career Scientist**

(zoom) Synergies of Survey Programs for Cosmic Frontier

Thursday, 23 February 2023 14:15 (5 minutes)

Observational Cosmology is driven by large collaborative experiments like Rubin, JWST, or Euclid. Discovery in these surveys necessitates the development of advanced analysis methodology, high-precision instrumentation, and collaborative work in large interdisciplinary collaborations. Synergies between different survey programs will be crucial to reach the science goals of upcoming survey programs like LSST and Cosmic Frontier.
Broad-band optical surveys strongly depend on external calibration using complementary spectroscopic surveys due to their limited ability to extract spectral information. Moving forward, it will be vital to design survey programs with these synergies in mind to reach the groundbreaking promises of Cosmic Frontier. In my short presentation, I will discuss some of these challenges and implications for future survey design.

Primary author: Dr RAU, Markus (Argonne National Laboratory)

Presenter: Dr RAU, Markus (Argonne National Laboratory)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **53** Type: **Early Career Scientist**

(zoom) Leveraging cross correlations to detect new physics

Thursday, 23 February 2023 14:50 (5 minutes)

Weak lensing science will enter into its prime as a cosmological probe over the coming decade, but we will not be able to fully exploit weak lensing measurements without supplemental cross-correlation measurements between weak lensing, spectroscopic galaxy surveys and the CMB. I will discuss ways that overlap between upcoming surveys such as Rubin, CMB S4 and Stage V spectroscopy can serve to mitigate dominant weak lensing systematics, highlighting needs for better simulations and forward models of cross-correlation measurements. These cross-correlations strengthen claimed detections of new physics, and allow for a richer measurement of the redshift and scale dependence of potential deviations from vanilla LCDM.

Primary author: Dr DEROSE, Joseph (LBNL)

Presenters: NIKOLA, Andrina; Dr DEROSE, Joseph (LBNL)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **54** Type: **not specified**

Synergy between cosmological research and the FCC program

Thursday, 23 February 2023 16:05 (5 minutes)

Compelling evidence from cosmological observations indicates gravitational interactions of a new particle - "Dark Matter". One of the most important goals of the "Cosmic Frontier"is to make more precise measurements that will lead to a deeper understanding of this "beyond the standard model"phenomena. This understanding can be made deeper through complementary studies based at colliders. The FCC could provide an opportunity to make precision studies of dark matter for several compelling dark matter candidates - among these dark matter models that interact with ordinary matter via a Higgs portal, and dark matter related to neutrino mass models. The FCC program can probe a large spectrum of DM scenarios: from the traditional WIMP paradigm to more feebly interacting scenarios, including axions. Amongst the wide variety of dark matter candidates - and dark sectors more generally - that can only be explored at FCC-ee and FCC-hh, Weakly Interacting Massive Particles (WIMPs) remain a highly motivated scenario. Thermal relic WIMPs in the doublet and triplet SU(2) representations have an upper bound on their mass around 1 and 3 TeV respectively. FCC-hh can cover this entire range to either exclude or discover these thermal WIMP scenarios that would otherwise be left unexplored by other means. The FCC program can also constrain other parameters of cosmological interest, such as the effective number of neutrinos.

Presenter: COLLABORATION, The US FCC

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **56** Type: **Early Career Scientist**

(zoom) Joint Modelling of Astrophysical Systematics for Cosmology with LSST

Thursday, 23 February 2023 16:25 (5 minutes)

The future of cosmology looks bright: several ground and space telescopes being built, thousands of people coming together in an effort to uncover the riddles of dark matter and dark energy. No one can deny the wealth of data that these detectors will bring. However, it would be beneficial to examine if our strategies and analysis choices will help answer fundamental questions. In this rush to find the answers, it would be good to re-evaluate our strategies. These assessments have to be applied to every facet of research. In this talk I would like to raise (and answer) several questions I believe we should be asking ourselves: Do we have enough cross-pollination efforts between the collaborations? How good and up-to-date are our computing protocols? What biases are hidden or overlooked in our modelling choices? Can we get some physics insight from already-existing data and steer our future analyses into different directions?

One step towards answering these questions is the LSST DESC project, where we are trying to understand the underlying physics through a joint modeling approach to systematics. The outcome of this investigation will provide, not only more rigorous constraints on the cosmological parameters, but also provide a deeper understanding if there exists a degeneracy between the parameters used in our models. If such degeneracies exist, we will be able to use them to pave the path towards a better understanding of the Universe.

Primary author: Ms SARCEVIC, Niko (Newcastle University)

Presenter: Ms SARCEVIC, Niko (Newcastle University)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **61** Type: **Early Career Scientist**

Cross-survey tools and simulations

The tightest constraints on cosmological parameters will be obtained from the combination of different cosmological probes such as galaxy clustering, weak lensing, and CMB. The combination of data from surveys such as LSST, Euclid, Roman, and CMB S4 hold the promise to test the foundations of our cosmologiucal model. These joint analyses will require signifcant cross-survey collaboration and common analysis tools. As an example, sets of correlated simulations will be essential for pipeline validation as well as novel analysis methods based on forward-modeling. We would therefore like to advocate for significant support of cross-suvey efforts to homogenize analysis tools, as well as the development of joint simulation frameworks in order to facilitate these joint analyses.

In addition, the analysis of data from upcoming experiments will significantly benefit from continued access to and expertise on data from current surveys. We therefore advocate that relevant data bases as well as expertise be kept in place, even after precursor surveys end their nominal lifetime.

Primary author: Ms NICOLA, Andrina (Argelander Institut für Astronomie, Bonn)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **62** Type: **Early Career Scientist**

(zoom) Continued support for funding small-scale experiments

Thursday, 23 February 2023 14:35 (5 minutes)

The dark matter parameter space is enormous and there is no one-size-fits-all experiment that can cover it all. Dozens of proposals for novel experiments exist in the literature but are stymied from "graduating" from the page to the laboratory by a lack of funding opportunities for small-scale experiments at the 100k level. The recent Dark Matter New Initiatives program from DOE provides an excellent model for how to fund experiments at the 1M scale which have already achieved sufficient R&D to guarantee science return, but a parallel program at a smaller funding level would enable R&D for cutting-edge ideas. I wish to strongly advocate for continued funding for such small experiments, which would provide a spectacular return on investment.

Primary author: KAHN, Yonatan (University of Illinois Urbana-Champaign)

Presenter: KAHN, Yonatan (University of Illinois Urbana-Champaign)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **64** Type: **not specified**

Leveraging Microelectronics through Dedicated Support for Implementation in HEP Experiments

Thursday, 23 February 2023 14:30 (5 minutes)

Funding for microelectronics presents a tremendous opportunity for developing the next generation of tools enabling the cosmic frontier. The funding has focused on the very valuable ASIC (Application Specific Integrated Circuit) design and fabrication. Taking full advantage of these developments requires dedicated support for their implementation in HEP experiments, in the intersection between engineering and physics. Without this dedicated support many of these microelectronic developments could end up being not fully utilized, leading to missed opportunities for experiments and industries. To fully realize the potential of new microelectronics developments, it is essential to allocate resources towards implementing them in HEP (including device characterization and testing). Investing in a technical qualified workforce with focus on HEP to implement these devices can ensure that ASICs meet their intended specifications and function effectively in real-world applications.

Primary author: TIFFENBERG, Javier (Fermilab)

Presenter: TIFFENBERG, Javier (Fermilab)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **65** Type: **not specified**

Artificial Intelligence as a Core Component of the Cosmology Research

Thursday, 23 February 2023 14:40 (5 minutes)

A unique aspect of the next-generation astronomical surveys as a probe of dark energy and dark matter is in the use of multiple cross-checking probes observed with unprecedented precision. Due to the dataset complexity and size, working with the next-generation astronomical datasets will be challenging, and many tasks will either be too slow or not possible at all with classical approaches. Artificial Intelligence (AI) methods have already shown huge promise in increasing the quality and speed of work with big data from cosmological surveys - from finding, classifying and inferring properties of astrophysical objects, to constraining cosmological parameters and learning about dark matter and dark energy. The development of more advanced, robust, physics-aware AI algorithms, capable of combining knowledge from complex simulations and big astronomical surveys should be considered a core component of the future cosmology and astrophysics research.

Primary author: Dr CIPRIJANOVIC, Aleksandra (FNAL)

Presenter: Dr CIPRIJANOVIC, Aleksandra (FNAL)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **68** Type: **not specified**

(zoom) Seeing the Universe in 3-d

Thursday, 23 February 2023 15:45 (5 minutes)

The large-scale structure in the Universe is a marvelous laboratory for the study of cosmological physics. By measuring the detailed statistics of the clustering, we can explore important extensions of the standard cosmological model: variations in dark energy density, modifications to large-scale gravity, non-vanilla primordial initial conditions (changes in the primordial power spectrum, novel isocurvature modes, or non-Gaussianity), and so on. We should view large-scale structure as an opportunity for a broad exploration of cosmological physics, and not merely reduce it to a limited set of parameterized models.

Our study of large-scale structure is best done with multiple views: the primordial CMB for the simplicity of the early plasma, gravitational lensing for its access to the true matter distribution, Sunyaev-Zel'dovich for its ability to detect the highest density peaks. But here I want to stress the important role of three-dimensional surveys using spectroscopic redshifts. This is the cleanest mechanism we have to map the cosmic web in detail. With precise redshifts, we can access more linear-theory modes, leverage the environmental markers such as galaxy groups, measure redshift distortions, and avoid the confounding effects that redshift mistakes at even the percent level will cause in high-precision clustering measurements.

As our planning horizon stretches beyond the Rubin/CMB-S4 era, I see large spectroscopic samples growing in importance as our questions get more subtle and the crispness of these maps becomes more prized.

Primary author: Prof. EISENSTEIN, Daniel (Harvard University)

Presenter: Prof. EISENSTEIN, Daniel (Harvard University)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **70** Type: **not specified**

Morning Refreshments

AM snacks and refreshments

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **71** Type: **not specified**

Morning Refreshments

AM snacks and refreshments

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **72** Type: **not specified**

Morning Refreshments

AM refreshments and snacks

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **73** Type: **not specified**

Going Green: A Renewable Energy Future for High Energy Physics at the South Pole

Thursday, 23 February 2023 14:20 (5 minutes)

Renewable energy sources are widely recognized for their ability to provide affordable, reliable energy with reduced environmental impact. As existing and future High-Energy Physics (HEP) experiments probe the Snowmass science drivers over the coming decades, renewable energy must be considered for integration into the supporting infrastructure. Each experimental site will offer challenges to such a transition and the South Pole site used by the cosmic frontier presents particularly singular conditions. Argonne National Laboratory and the National Renewable Energy Laboratory have combined their unique multidisciplinary expertises to evaluate the economic viability and technical challenges of renewable energy operation in this extreme environment. Through a detailed, customized analysis and system co-optimization, we find that significant decarbonization as well reduced operational cost is possible using mature, commercially available technologies. In these remarks, I will highlight the conclusions of this analysis and the opportunity of renewable energy.

Primary author: BENDER, Amy (Argonne National Laboratory)

Presenter: BENDER, Amy (Argonne National Laboratory)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **75** Type: **not specified**

Dark Matter in the Local Universe With DESI-II and S5

Thursday, 23 February 2023 15:00 (5 minutes)

Spectroscopic observations with wide field, extremely sensitive facilities like DESI-II and S5 can constrain the particle properties of dark matter through observations of the smallest cosmic structures in the Milky Way and local universe. The mass, interaction cross-section and other properties of dark matter help set the important physical scales in these systems. The mass spectrum and minimum mass of dark matter halos too small to host stars and galaxies can be inferred by the gaps and other perturbations these halos create when they encounter the ordered streams of stars from tidally disrupted Milky Way star clusters. The shape and symmetry properties of our Milky Way Galaxy's extended dark matter halo are also shaped by the properties of the dark matter particle, and can be mapped using the most distant stars in our Galaxy. The central mass density of the dark matter halos that host low-mass dwarf galaxies provide some of the best constraints on different dark matter candidates. All these observations require precise redshifts (velocities) for many stars in structures that span tens or even hundreds of degrees on the sky. Sensitive, wide-field spectroscopic facilities like DESI-II and S5 can map streams across hundreds of degrees to look for gaps and other perturbations. Their field of view is comparable to the sizes of Milky Way dwarf galaxies, making it possible to measure hundreds and even thousands of stars in these dwarfs to map the mass-density profiles of their dark matter halos and compare with predictions. Dedicated surveys of dwarf galaxies and stellar streams in the Milky Way are among the most promising ways to test the predictions from different dark matter candidates, and are complementary to searches with accelerators.

Primary author: ROCKOSI, Constance (UC Santa Cruz, SCIPP)

Presenter: ROCKOSI, Constance (UC Santa Cruz, SCIPP)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **77** Type: **Early Career Scientist**

(zoom) Support for xenon detector technology R&D to expand the reach of existing experiments

Thursday, 23 February 2023 14:55 (5 minutes)

The world-leading sensitivity of dark matter experiments such as LUX-ZEPLIN (LZ) is enabled by a strong foundation of liquid xenon detector research. However, many aspects of xenon detector technology are relatively unexplored, and potential improvements through R&D can dramatically extend the sensitivity of current experiments.

Examples of active areas of research to improve existing experiments include doping the xenon with lighter atoms and developing advanced methods of radon removal or mitigation. As these R&D efforts mature into implementable upgrades to the current experiments, the upgrades can fill the gap between G2 and G3 experiment timelines. R&D projects also serve as unique training grounds for young experimentalists. This becomes increasingly important as next-generation experiments grow in size and timescale. In addition, support for technology-focused R&D facilities, such as the Liquid Noble Test Facility (LNTF) at SLAC, can enable collaboration between different areas in particle physics which utilize common technologies.

Primary author: WANG, Ann (Stanford/SLAC)

Presenter: WANG, Ann (Stanford/SLAC)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **78** Type: **Early Career Scientist**

Next-generation Cosmology with Millimeter-Wave Line Intensity Mapping

Thursday, 23 February 2023 15:50 (5 minutes)

Line intensity mapping at millimeter wavelengths is a promising method of measuring large-scale structure and constraining cosmology, potentially beyond the reach of future optical surveys. I will outline the path forward to deploying future instruments with the required sensitivity for next-generation cosmological constraints, including developing large-format on-chip spectrometers and analysis of current pathfinders.

Primary author: KARKARE, Kirit (SLAC)

Presenters: ANDERSON, Adam (Fermi National Accelerator Laboratory); KARKARE, Kirit (SLAC); PAN, Zhaodi (Argonne National Laboratory)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **79** Type: **not specified**

Pathfinder Experiments for mm-Wave Intensity Mapping

Line intensity mapping (LIM) with emission lines redshifted into millimeter wavelengths is a powerful emerging probe of cosmological parameters and inflationary physics, and significant community interest was expressed in LIM during the Snowmass process. Several upcoming and ongoing experiments, including the SPT-SLIM camera on the South Pole Telescope, are currently performing on-sky demonstrations of new key technologies that will enable future larger-scale surveys. I will discuss the importance of supporting small pathfinder experiments similar to these projects, in order to develop the technologies needed for the next generation of surveys, specifically in the case of LIM.

Primary author: ANDERSON, Adam (Fermi National Accelerator Laboratory)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **82** Type: **Early Career Scientist**

(zoom) Survey synergies: direct calibration of weak lensing surveys with spectroscopy

Thursday, 23 February 2023 15:55 (5 minutes)

Upcoming imaging and spectroscopic surveys will provide unprecedented constraints on models of dark energy and cosmic inflation. I will briefly discuss key synergies between these two types of surveys that will enable us to maximize science returns in the coming decades, including the use of spectroscopy to directly calibrate and optimize weak lensing surveys such as LSST. Facilitating increased coordination between collaborations, however, will be critical to realize these gains.

Primary author: WEAVERDYCK, Noah

Presenter: WEAVERDYCK, Noah

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **84** Type: **Early Career Scientist**

Multi-probe measurements and mitigating systematics

Our ability to learn more about the properties of dark energy and dark matter involve combining information from a range of different cosmology probes. It is vital that we develop accurate models of the systematic errors that affect these measurements, so that we measure unbiased values of the cosmological parameters. We will also need to obtain spectroscopic redshifts for large numbers of objects observed in photometric surveys, including galaxies hosting distant supernovae and strongly lensed quasar systems. Rigorous modeling and significant spectroscopic follow up resources will help to ensure that our dark energy constraints are both accurate and precise.

Primary author: Dr PRINCE, Heather (Rutgers University)

Presenters: Dr PRINCE, Heather (Rutgers University); WEAVERDYCK, Noah

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **85** Type: **Early Career Scientist**

Dark Matter Physics in the Sky

The distribution of cosmic structure on small scales is extremely sensitive to dark matter physics, including its particle mass and non-gravitational interactions. I will describe how next-generation facilities will advance fundamental dark matter science, using future Rubin Observatory and spectroscopic measurements of ultra-faint dwarf galaxies, stellar streams, and strong lenses as a case study.

Primary author: NADLER, Ethan (Carnegie Observatories & USC)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **86** Type: **Early Career Scientist**

Multi-TeV colliders based on advanced accelerator concepts for the Energy Frontier

Thursday, 23 February 2023 16:15 (5 minutes)

As discussed at Snowmass, there is great interest in a lepton collider in the energy range of 10 TeV and beyond, where colliding elementary particles are anticipated to offer powerful signatures for discovery science. Ultrahigh-gradient Advanced Accelerator Concepts (AAC) offer an attractive path to enable such future colliders by significantly shrinking their size and enhancing their energy reach and efficiency while reducing their environmental impact. AAC technologies include large amplitude wakefields excited in plasmas or structures driven by intense laser pulses or particle beams. These generate acceleration fields in the range 1-100 GV/m, far greater than those achievable with conventional RF-based technologies. This implies that an AAC-based collider can be more compact, and less expensive. At the same time, their short beams and high gradients offer paths to greater efficiency than conventional approaches. Significant R&D is still required to realize any collider at this scale, and AAC research programs are making strong progress in the US and around the world. In the US, the General Accelerator R&D program-funded Beam Test Facilities have recently demonstrated milestones including staging of two modules and single stages of 8 GeV in 20 cm at LBNL's BELLA for laser-plasma accelerators; efficient wake energy transfer and positron acceleration at SLAC's FACET and now FACET II for particle-beam-driven plasma accelerators; high gradient structures and other attributes at AWA at ANL for beam driven structures; and ATF at BNL for beam-driven and CO2 laser-driven accelerators, together with strong University Programs. This active research area world-wide attracts many early career scientists and hundreds of papers are published each year reflecting rapid progress in AAC topics. Large investments are being made overseas in the potential of these technologies, which also threatens US leadership. It is timely to leverage recent progress and investment to move forward with collider options realizing these groundbreaking technologies. This includes: funding research at a vigorous level, together with upgrades to the Beam Test Facilities to ensure international competitiveness, enhanced R&D on high average power drive beams, and initiation of an integrated design study of an AAC collider, and exploration of an intermediate AAC collider facility.

For those that are here at LBNL for this townhall, you are invited to tour the BELLA PW laser facility and learn more about our laser-plasma accelerator activities.

Primary author: Dr OBST-HUEBL, Lieselotte (LBNL)

Presenter: Dr OBST-HUEBL, Lieselotte (LBNL)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **88** Type: **not specified**

(zoom) Research Funding in Cosmic Frontier and throughout HEP

Thursday, 23 February 2023 14:45 (5 minutes)

Dear P5 members,

The last decade has seen tremendous progress in Cosmic Frontier research, including significant advances in measuring the properties of Dark Energy, several orders of magnitude increase in sensitivity to Dark Matter over a variety of different mass scales, compelling arguments for the existence of new physics beyond the Standard Model, and a strong record of delivery on projects and physics. Research funding, and university groups in particular, are crucial for delivering these advances, providing ideas for new experiments and much of the workforce to carry them out and deliver the science.

We are writing to highlight that university scientific research support for all frontiers but particularly the Cosmic Frontier is hitting a dangerously low level. For example, the expected level today for new faculty in the Cosmic Frontier is to asymptote at a level of 1 postdoc and 1 graduate student, and that is only after several rounds of positive reviews (link). This level of PI funding makes it difficult to fulfill our goals of either contributing significantly to the design and construction of new instruments or delivering great results during the science-exploitation phase of experiments. The new norm prevents the development of critical science capabilities, limits diversity within groups, and hampers continuity of experience/training. Limited support for scientific travel restricts an important component of the training of young scientists. We will not retain the students and postdocs critical to our science.

As things stand currently, most faculty are forced to go outside the base grant for additional piecemeal resources to maintain a viable group, leading to more time spent writing (and more often than not failing to obtain) grants, less time for mentoring young scientists, and an overall distraction from the core scientific missions of the funding agencies. New initiatives such as Quantum Science and efforts in Artificial Intelligence and Machine Learning are welcome, but cannot replace adequate base research funding.

We ask that P5 carry forward the recommendations of previous panels such as the 2014 P5 and the 2020 Committee of Visitors in raising the issue of research support for labs and universities across HEP, and Cosmic Frontier in particular, with the agencies at every level possible, and with as much data as can be gathered. New physics is out there to be discovered but it will not happen without appropriate investment.

Thank you for your attention.

Primary authors: LIPPINCOTT, Hugh (UCSB); GAITSKELL, Rick (Brown)

Presenters: LIPPINCOTT, Hugh (UCSB); GAITSKELL, Rick (Brown)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **89** Type: **not specified**

Rubin Observatory as a Flagship Dark Matter Experiment

Although dark matter plays a lead role in driving the expansion of the universe and the growth of structure, its fundamental nature remains a mystery to humans. In the absence of a definitive detection of it in a laboratory setting, the theoretical landscape of plausible particle dark matter candidates has grown broader and more diverse in the past decade since the last Snowmass process. Even as the laboratory searches to discover these candidates also diversify, the study of the fundamental particle properties of dark matter in its native context, the cosmos, is becoming a precision science. I will outline how dark matter astrophysics has become a precision science, and advocate for the idea that we should be thinking of telescopes as dark matter experiments. While I will focus on the Rubin Observatory, I will emphasize that this framing and approach suits a broad range of future projects.

Primary author: Prof. PETER, Annika (OSU)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **92** Type: **not specified**

Rubin Observatory and new avenues

Large galaxy surveys like the Vera C. Rubin Observatory Legacy Survey of Space (LSST) are ushering us into exciting times –not only our methodology needs are changing (to e.g., more advanced methods like Hierarchical Bayesian Inference, Simulations Based Inference) but we will also have new probes to work with to study fundamental physics (including clusters of galaxies and gravitational wave sources; not to mention the yet-to-be-discovered ones). Cross-survey synergies and access to multi-wavelength data are also going to be ever-more critical with these undertakings as only then can we break some of the cosmological parameter degeneracies in our data. All of this of course relies on effective collaborations and community building –the powerhouses behind the success of these large projects, and a place for empowerment and change through robust interactions across the globe.

Primary author: AWAN, Humna (University of Michigan)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **93** Type: **Early Career Scientist**

Advancing Detector Technology for Mm/submm-wavelength Line Intensity Mapping

Mm/submm-wavelength line intensity mapping (LIM) uses the intensity and redshift of mm/submm molecular emission lines to trace the 3D large-scale structure (LSS) of the universe. Compared to observations at other wavelengths, LIM can probe higher redshift than optical surveys and access more independent information than the 2D cosmic microwave background (CMB). The opportunity is to advance the spectroscopy technologies and scale them up to the size of current and next-generation CMB surveys to cross critical thresholds in primordial non-Gaussianity, neutrino mass, light relics, and dark energy. Silicon chips provide an ideal platform for building high-density integrated spectrometer sensor arrays, which are vital in improving the sensitivity of the experiments. However, we need to address a few technological challenges, such as sensor packing density, spectral resolution, optical efficiency, and noise, to mature the current on-chip spectrometer technology toward kilo-spectrometer arrays with rivaling constraining power compared to the CMB experiments. I will summarize the current sensor technology status, our efforts in optimizing the sensors for small demonstration experiments, and some future directions that need more investment.

Primary author: PAN, Zhaodi (Argonne National Laboratory)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **95** Type: **Early Career Scientist**

(zoom) Foster the Development Necessary for the Next Generation of Flagship Projects

Thursday, 23 February 2023 15:05 (5 minutes)

Observations of the cosmic microwave background (CMB) have been pivotal in establishing ΛCDM as the standard model of cosmology and are providing a critical avenue for the exploration of particle physics beyond the standard model. CMB-S4 is the pivotal next step in CMB observations and, especially when combined with large scale optical surveys such as DESI and LSST, will significantly expand our understanding of the contents and evolution of the universe.

These large-scale experiments will and should be the main focus of the cosmic frontier in the coming decade. However, while undertaking these flagship projects, it is also important to provide avenues for smaller scale experiments pursuing new measurement methods and technological development. Smaller scale projects and test-beds are the seeds of the new methods and technologies that are required for the next generation of flagship projects and are a very important training ground for the next generation of physicists.

Primary author: Dr HARRINGTON, Katie (Argonne National Lab)

Presenter: Dr HARRINGTON, Katie (Argonne National Lab)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **96** Type: **not specified**

Open-Mic Session

Thursday, 23 February 2023 16:30 (30 minutes)

Session Classification: Open Session for Remarks and Discussions

Contribution ID: **97** Type: **not specified**

Survey on the Town Hall at LBNL

Thursday, 23 February 2023 12:10 (5 minutes)

Presenter: MURAYAMA, Hitoshi

Session Classification: New Opportunities