COSMIC NOMINATIONS

From David Schlegel:

Simone Ferraro (Berkeley Lab) is nominated as convener for Inflation and the Early Universe, or as convener for Dark Energy and Cosmic Expansion. He is a recongized leader in both areas largely for his theoretical insights, but also for his analysis of cutting-edge data sets from CMB and galaxy maps. Simone led the development of the Astro2020 white paper "Inflation and Dark Energy from spectroscopy at z>2", which was endorsed by 143 authors (https://arxiv.org/abs/1903.09208).

Peter Nugent (Berkeley Lab Computational Research Division) is nominated as convener for Expansion (H0) and Expansion History Probes. He has published extensively in different areas of the cosmic frontier, including supernova cosmology and N-body and hydro simulations. His current research is focused in the area of H0 probes, including supernovae, peculiar velocities and gravitational lensing. He is Head for Computational Science in the Computing division at Berkeley Lab, and has served on numerous DOE and cross-lab committees. He has enthusiastically volunteered to participate in Snowmass.

Julien Guy (Berkeley Lab) is nominated as convener for Cosmic Observatories/ Facilities. Julien has worked in the area of dark matter detection (HESS experiment), supernova cosmology (SNLS experiment), Lyman-alpha forest (eBOSS experiment), and is currently co-Project Scientist for the DESI experiment. He has extensive experimental knowledge, and would bring some international perspective as he was the lab group leader at LPNHE, Paris before moving to the US.

Martin White (UC Berkeley faculty) is nominated as convener for the Dark Energy & Cosmic Expansion. He has published extensively on the experimental and analysis methods for both CMB and large scale structure experiments. He developed many of the analysis methods in use today. He was Chair of the survey science team for the BOSS experiment. He was a member of the Planck core team and chair of the US advisory board. I have not had the opportunity to ask if he would be willing to serve, but he likely would and would be an excellent choice.

Alex Kim (Berkeley Lab) is nominated as convener for Expansion (H0) and Expansion History Probes. Alex has extensive work in supernova cosmology, the DES experiment, and LSST. His recent work is focused on designs for H0 and gravity measures from future peculiar velocity surveys. That's likely to be an area of research growth given future experimental reach.

From Aida El-Khadra:

Yonatan (Yoni) Kahn (U. Illinois) As you probably know, Yoni's research interests are centered around dark matter and its detection strategies. He works closely with experimentalists, and has made important contributions, including also to accelerator based experiments. He has initiated interdisciplinary efforts, working with condensed matter experimentalists and theorists.

I know that he is also very interested in contributing to the Snowmass process. Hence he is an ideal

candidate to lead a topical group on dark matter. Since the two related topics are listed in the cosmic and precision frontiers, respectively, I am sending this email to all four of you.

From William Wester:

Marcelle Soares-Santos She would be particularly suited to: Gravitational waves as probes of cosmology and fundamental physics. I have worked with Marcelle at Fermilab and have really admired how she helped start the new field of multi-messenger astronomy in a way that has focused upon cosmology. She has lead teams and is very highly respected. I think she is exactly the kind of person to be a convener.

From Lindley Winslow:

Lindley Winslow: I wanted to nominate myself as a convener for the cosmic frontier. My expertise is direct dark matter experiments especially axions, but also very familiar with the WIMP searches since they use the same techniques as searches for neutrinoless double-beta decay.

The cosmic frontier is very broad, and I would be interested in diving into the other subjects and putting my astronomy degree to good use. I have gotten to start with the photodetectors and the BRN that is in progress now.

I would also be happy as a topic convener.

From Hitoshi Maruyama:

I wholeheartedly nominate **Yanou Cui** <yanou@ucr.edu> as a convener of the cosmic frontier. She would be a wonderful addition in particular to the working group on "Gravitational waves as probes of cosmology and fundamental physics". She has written many interesting papers on this subject, and is very willing to contribute to the community in this area. I believe she would be a fantastic young force for the Snowmass process that is crucial for our community.

From Doojin Kim

My name is Doojin Kim, a postdoctoral associate in Texas A&M University. I am writing this message to nominate leader candidates for Dark Sector Phenomenology and New Directions group.

KC Chong and HaiBo Yu: First of all, I would like to nominate Prof. KC Kong in the University of Kansas and Prof. Hai-Bo Yu in the University of California, Riverside. I believe both of them have broad knowledge and interests in various dark sector phenomenology and new directions in terms of dark matter searches. More specifically, Dr. Kong is one of the authors of MadDM and has performed research works on multi-component dark sector phenomenology. Dr. Yu is an expert on self-interacting dark matter models and related phenomenology. Given their research backgrounds, I believe that they will constructively serve the cosmic frontier as a group leader, reinforcing the spirit of the team work.

Doojin Kim: Second, if allowed, I also would like to volunteer to serve as a leader of Dark Sector Phenomenology and New Directions group. While I have benefited very much from American Physics Society in various aspects since my PhD days, I could seldom find chances to make a contribution to the community. I feel that the upcoming Snowmass will be an excellent opportunity to make a sincere contribution with my expertise and passion toward the area. I would be very honored if a chance is given to me.

From Bo Jayatilaka:

Bjoern Penning: I am writing to nominate Bjoern Penning [Brandeis] to be a convener of dark matter direct detection working group in the cosmic frontier for Snowmass 2021. Bjoern has a unique career path where he worked extensively on collider-based dark matter searches at both ATLAS and CMS before switching his focus to direct dark matter searches at LZ. I have worked with him in his collider days and I have no doubt that his strong background in analysis, phenomenology, and detector building make him ideally suitable for this role.

Carosi Self 11/14

Gianpaolo Carosi: I'd like to take this opportunity to nominate myself as a topic convener for the upcoming Snowmass Community Planning meeting's Dark Matter subpanel: Waves (Axions/ALP-Like). The discovery of dark matter axions is a passion of mine and has been the primary focus of my professional career. As co-spokesperson of the Axion Dark Matter Experiment (ADMX) I'm quite familiar with the experimental challenges of searching for this elusive particle. In addition I've been following closely the renaissance in proposed axion detection methods from ultra-low mass searches using NMR techniques to open resonator cavity concepts and complimentary searches for solar and lab based axion searches. I've had the privilege to organize several workshops and reviews over the years including an upcoming "Axions beyond Gen 2" workshop in Seattle this coming March. I believe this gives me the experience required to help organize this topic as part of the Snowmass process. In addition as the LLNL Point of Contact with DOE HEP I have a broad view of the programs outside of DM axion searches. I think this gives me a unique perspective to identify and develop synergies with other topics, Frontiers and communities. I hope that you'll consider me as a topic convener and I look forward to helping organize this important planning process.

Tom Browder:

I would like to nominate Professor **Sven Vahsen**, the US leader in directional dark matter detection, leading member of the CYGNUS proto-collaboration.

Note that directional dark matter is not clearly a sub-topic in the cosmic frontier.
There are close synergies between directional dark matter work and coherent neutrino scattering.

Eric Dahl:

I'd like to nominate **Hugh Lippincott** for Cosmic Frontier convener, or for Dark Matter direct detection group leader.

With regards to direct detection, very few people understand the challenges facing the field as it moves forward at the level Hugh does. He's personally shown leadership in every large-scale WIMP detection technique now going forward (argon, xenon, bubble chambers), and has the experience needed to realistically consider where we can and should move forward in the coming years.

More generally, Hugh's a fantastic scientist, and a statesman as well. He is not the type to let his own personal objectives dominate the narrative, but at the same time he has a spectacular knack for calling out problematic issues, which he can somehow do without leaving anybody offended. He's also in a unique position to see both the national lab and university perspectives, having just moved from Fermilab (Scientist, former Wilson Fellow) to UCSB (junior faculty).

James Wells:

I'd like to nominate Prof. **Yanou Cui** (UC Riverside) for a convenor position for the Snowmass 2021 study. Yanou would be great as a comic frontier convenor and/or topical group leader for GW study or new directions in dark matter research. She has become an internationally recognized expert in these areas of physics, has tremendous organizational skills, is very responsible, and is very dedicated to any endeavor she agrees to do. She would do an outstanding job in that capacity.

Yuanyuan Zhang:

I'd like to nominate **Arka Banerjee** at Stanford for the snowmass process in the cosmic frontier, related to Astrophysical DM probes as well as cosmic neutrino property probes.

Arka has been working on cosmic simulations of dark matter and cosmic neutrino properties, and is involved in the experimental studies using data from the Dark Energy Survey and LSST. Please let me know if you'd need anything else for this nomination.

https://arxiv.org/search/astro-ph?query=Banerjee%2C+Arka&searchtype=author&abstracts=show&order=-announced_date_first&size=50

Craig Hogan:

I'd like to nominate **Marcelle Soares-Santos** as a convenor for "Gravitational waves as probes of cosmology and fundamental physics". She has shown considerable energy, imagination and talent in shaping new programs and making them work. In particular in this area, the successes of DES+LIGO owe much to her. She's also very good at community building, which is so important for Snowmass to succeed.

Andreas Kronfeld:

As I mentioned in an earlier email, the USQCD would like to suggest some possible topical group leaders. If you are leaving it to conveners to choose people to fill these roles, please convey this information to them, or let me know so I can do so.

There is one area where lattice gauge theory will be important for this frontier:

Strongly coupled dark matter: **Ethan Neil** <Ethan.Neil@Colorado.EDU> is an expert in these models both from the phenomenological point of view as well as nonperturbative studies with lattice gauge theory.

He is well connected to the DM and BSM communities, having organized several workshops. You can probably think of others who have worked on strongly coupled dark matter, but most of them will not be as familiar with lattice gauge theory as Ethan is with the whole subject.

Marcelle Soares-Santos:

I am writing to nominate **Brenna Flaugher** (flaugher@fnal.gov) for a position as convener of the Snowmass working group on "Cosmic Observatories/Facilities (CMB, O/IR, Radio, Gamma ray, Cosmic ray, grav. wave, etc.)".

Brenna is a particle physicist (formerly a member of CDF) who led the DECam construction project in DES, is head of Astrophysics at Fermilab, and has held leadership positions in DESI and now in the CMB-S4 project. She is an outstanding leader and project manager with wide-ranging experience. Specially considering the broad scope of the Cosmic Observatories/Facilities working group, I cannot think of another person who would be a better match for this convenership.

Marcelle Soares-Santos:

I am writing to nominate **James Annis** (annis@fnal.gov) for a position as convener of the topical group on "Growth of Structure Probes of Dark Energy". Jim is a key player in the field of observational cosmology with galaxy clusters and his experience, going from SDSS to DES and now to LSST, will be invaluable to the community in the snowmass process.

Jim was the first to introduce the red sequence-based method to find galaxy clusters in optical survey data, a method that is currently widely used in the community and is presently implemented in a code known as redmapper. He also was the first to propose that we attempt to use the stellar mass of cluster members as a physically motivated robust proxy for the cluster mass, an idea that has been since been further developed with contributions of members of my group and others in the DES collaboration and is now accepted by the DES as an important component of galaxy cluster studies, with potential of reducing systematic uncertainties in cosmological analyses. These are a few examples of Jim's forward thinking approaches to the topic, and I sincerely believe he will bring a bold vision into focus if he becomes convener of this topical group.

Chip Brock:

I have a nomination that I'd like to put forward for a Topical group - but I don't know which one!

Bjoern Penning, Topical Convener of Accelerator Searches for DM and long-lived particles and/or Dark Matter Direct Detection. Bjoern Penning is an assistant professor at Brandeis with an unusual background - a cross-cutting background. I know him as a "conventional" D0 and ATLAS colleague where in ATLAS he began to focus on searches for Dark Matter in the "anything + missing energy" search strategies. He always had an eye on combinations of Dark Matter searches. As is well-known he was at Bristol on CMS after his Lederman Fellowship at Fermilab. He recently went to Brandeis after shifting his career toward direct searches with LZ. In my opinion, Bjoern is uniquely able to straddle experiment; theory; and important for this physics, combinations of search strategies. He's both a capable collider physicist and now into a much different technical pursuit - but always with his eye on the critical future of Dark Matter.

If you know Bjoern, and I'll bet you do, you know him to be maximally enthusiastic and talented as a motivator and "collector" of people. These convener jobs - especially for the extended Snowmass project - require physics talent, sure. But energy and enthusiasm and the ability to organize and infect others with energy and enthusiasm are really critical. Bjoern stands out in all of these areas.

I'd remind you - from the last Snowmass - that Bjoern was the prime-mover of the "Young Snowmass" effort that by the time we got to Minneapolis, was "a thing." Typical Bjoern.

In a number of venues I've moaned about one of the ways that I think we missed the mark during the last Snowmass in which I was a co-convener with Peskin of the Energy Frontier. We were inventing as we went along, of course. We missed the mark by not having baked in the connective tissue that blends the Frontiers together. We just couldn't do it well that first time around. But Snowmass Frontiers should not be siloed this time and Bjoern is precisely the kind of person who could deftly straddle these barriers.

So I hope you can find a way to ask him to lead one or more of the Topical Groups - or invent a glue-group between the accelerator and direct search efforts for Dark Matter.

Tim Tait:

I would like to nominate **Rouven Essig** of Stony Brook University (rouven.essig@stonybrook.edu) as sub convener of the topic on direct detection. Rouven is a theoretical physicist who is broadly accomplished, including having proposed and worked on the theoretical predictions for many of the detector concepts aimed at the sub-GeV mass dark matter detectors. He is also very responsible, and I am confidant that he would provide effective and balanced leadership to inform the Snowmass process for this area.

Kyle Dawson:

For the main Cosmic Frontier conveners, it would make sense to have one person from a dark matter background and one person from a cosmology background. The dark matter person would preferably be a theorist with perspective on the full phase space of dark matter phenomenology that spans experimental techniques. Clustering techniques are likely the path forward for cosmology, so the theoretical phase space and techniques are more clearly defined. I therefore think the cosmologist should be closer to experiment with a view of technical capabilities and the breadth of science drivers. I do not have a recommendation for dark matter, although there are many good choices. I nominate either **myself or Rachel Mandelbaum** (CMU) as the cosmologist for the Cosmic Frontier convener. I have not talked with Rachel about this nomination, but she has an excellent understanding of the technical and scientific challenges behind a large survey and has played a key role in defining the needs for next generation experiments. She is more theoretically oriented than I am, and she is more focused on a particular technique (weak lensing) than I am. I am nominating myself because of my broad background in cosmology and experimental techniques, and because of my recent contributions to dark energy strategic planning within the DOE community.

On background, my PhD thesis was in studies of the cosmic microwave background, so I have a good understanding of those techniques and maintain a good relationship with that research community. My postdoctoral work was divided between instrumentation and observational cosmology with optical imaging. In instrumentation, I worked with Natalie Roe and Steve Holland in R&D toward deep-depletion CCDs that are now used in BOSS, DES, and DESI. I continue to work with Steve, not in direct

R&D, but in trying to connect the technical capabilities that are being developed in that lab to future cosmology programs. In research, I studied Type Ia supernovae with the Hubble Space Telescope and coordinated a survey that led to some of the best high redshift constraints on the Hubble Diagram. As with CMB, I am quite familiar with the SNe community and their future plans. Finally, I am the PI of eBOSS, which concludes the largest spectroscopic survey of the sky ever conducted. I work with the Collaboration in operations, development of the data pipeline, low redshift clustering measurements, high redshift clustering measurements, Lyman-alpha forest clustering, and implications for our distance scale and growth of structure measurements on cosmology. The postdocs in my group have worked across the board in supernovae, galaxy clustering, Lyman-alpha forest clustering, and data characterization. I am playing a key role in DESI and will continue to do so over the duration of that survey.

Over the last ~4 years I have tried to synthesize these experiences toward long term planning in cosmology. I have been the proponent for a large spectroscopic facility that could be pursued in a partnership with the European Southern Observatory (https://ui.adsabs.harvard.edu/abs/2019arXiv190706797E/abstract). I have advocated for technical R&D toward that effort through the Cosmic Visions Dark Energy group both publicly (https://ui.adsabs.harvard.edu/abs/2018arXiv180207216D/abstract) and privately through direct communications with DOE. I am now the representative for galaxy surveys for the upcoming HEP-wide Basic Research Needs workshop and report. In these technical efforts, I am learning that the cosmology science cases for z>1.5 spectroscopy are fairly well-developed in the Astro2020 white papers and within the community. However, there is less development of deep spectroscopy as a tool to explore the transition to the accelerating epochs (z<1.5) where the dynamic nature of dark energy is most prevalent. If I were a convener for the Cosmic Frontier, I would specifically elicit discussion on what cosmological information will still remain to be tapped through 3D clustering over 0<z<1.5 after DESI, LSST, and Euclid are complete and how a future facility should be designed toward that regime. I would then work with the other sub-topic conveners to contrast the benefits of optical/IR spectroscopy with 21-cm spectroscopy across the full range of science drivers and redshifts, and try to build a coherent picture of instrumental capabilities toward those cases.

If you'd like to hear about my contributions in the last Snowmass, I would recommend that you talk with Scott Dodelson who organized the cosmology component in 2013. Likewise, if you'd like to discuss any details of my possible role as convener, I would be happy to talk over the phone.

Beyond the main conveners, here is a list of suggestions for each sub-topic. I have only talked with Anze on this list, so these are based only on my past experience and not on any recent planning. For whatever it is worth, my opinion is that the two Cosmic Frontier conveners should arrange a short skype interview with all of the nominees to gauge their ideas, willingness to dedicate time and effort, and ability to coordinate with other sub-topic conveners. That should be done before finalizing the leads of the sub-topics. What I saw in the 2013 Snowmass was that some WG leads really pushed novel ideas and helped re-define science drivers while others did nothing or simply stepped back and avoided projections into the future. There were no major consequences in 2013 because DESI was already at CD-0 and LSST was effectively a done-deal. We need to avoid reproducing those disengaged working groups because there is no established Stage-V dark energy program, making this Snowmass process far more important for dark energy than in 2013.

Brenda Dingus:

I nominate **Tracy Slatyer** (MIT Associate Prof, PECASE recipient, 2014 Rossi prize winner, 2017 APS Primakoff Early-Career Particle Physics awardee) to be a convener of the cosmic frontier. She is a particle physics theorist who has coauthored 57 papers of which 50 were since her PhD from Harvard in 2010. Her papers are highly cited with nearly 6000 citations and an h-index of 32. She is a particle theorist, but has strong connections to the experimental community. For example, she has placed strong constraints on dark matter with her interpretations of gamma-ray and cosmic microwave observations.

Alex Kim:

I would like to nominate **myself** as convener for either "Growth of structure probes" or "Probes/Tests of General Relativity".

My expertise is in Dark Energy and Cosmic Expansion and I served as a co-convener (with Nikhil Padmanabhan) in the Cosmic Frontiers "Distances" subgroup for Snowmass 2013. My specific interest now is in the use of peculiar velocities as a probe of physics and cosmology, for which I led a white paper (https://arxiv.org/abs/1903.07652) for the 2019 Decadal Survey. Within the structure of this Snowmass process, peculiar velocities best fit in within "Growth of structure probes" as an alternative to redshift surveys, and "Probes/Tests of General Relativity" as peculiar velocities are sensitive to the combination f sigma_8, which provides a test of General Relativity.

Kevin Lesko:

The LZ Executive Board has met and discussed ways we will be able to best advance the discussion of direct detection of Dark Matter in the upcoming SNOWMASS process. In addition to our collaboration's plans to actively participate in the process, we are nominating one of our numbers as a dark matter convener: **Rick Gaitskell,** Brown University, richard_gaitskell@brown.edu, phone 401 289 0151 .

Rick has devoted his physics career to searching for Dark Matter. He has worked within the CDMS, XENON, LUX and LZ collaborations. He was spokesperson for LUX and continues to play critical roles within LZ.   He understands the issues associated with signal detection, instrument development, past history, and future challenges for the experiments. Rick has an excellent working knowledge of the theoretical underpinnings of the different dark matter models. He is very well known by and respected by the international community.

Having recently completed his hardware contributions to LZ, he is aware of the administrative demands of the convener position and is excited to help the physics community understand the challenges and opportunities of direct detection. I am convinced he will ensure the field is well represented at SNOWMASS and will attract the full community to the discussion of the next steps.

LZ is one of the two US flagship experiments pursuing WIMPs. The collaboration is preparing for first data next year and is keenly aware that our findings will be essential for discussing future efforts. We are certain that Rick is the correct individual for this high visibility and critical role. He has the strong support of the entire LZ collaboration for this position.

Andrew Sonnenschein:

Jim Buckley for Cosmic Frontier Convener.

Jim would be a good choice as the convener for the Cosmic Frontier. I've noticed that he's very good at committee work, including organizational and writing aspects. He has an unusually broad experience since much of his career has been spent in gamma ray astronomy and indirect dark matter detection and in recent years has worked on both WIMP and axions direct detection.

Hugh Lippincott for the dark matter direct detection subgroup or the WIMP detection subgroup. He was our "go to" person in PICO for editing large documents with many coauthors and he's very good at that.

Gray Rybka for the "Waves" subgroup. Rybka is ADMX co spokesperson and has co-authored the review article on axion searches for the Particle Data Group.

Yusin Tsai:

I want to nominate **Yanou Cui** as the convener and/or topic group leader for the Cosmic Frontier.

Yanou has done many important works on cosmology relating to DM and GW. She also has been organizing useful workshops, such as the Hot Big Bang workshop in KITP next spring, which will strengthen the communication between particle physicists and cosmologists. She is also a member of Dune and an associated member of LISA and has good connections to the experimentalists who are interested in BSM searches. I will be very happy to contribute to the topics she lead for the Snowmass project.

She can also be a good fit for topic group leader, including topics like

"GW cosmology"
"Astrophysical DM probes"
"Cosmic probes of neutrino properties"
"DM direct detection/DS pheno and new directions"

Yanou Cui:

I'd like to nominate **Yuhsin Tsai** as a topical group leader for Cosmic Frontier, in particular for the subjects of "Cosmic probes of neutrino properties" and/or "DM direct detection/DS pheno and new directions". Yuhsin is currently finishing his postdoc position at UMD and has a faculty position lined up at Notre Dame. He has done a good amount of related work in particle cosmology/astrophysics in recent years.

Jonathan Feng:

I write to nominate **Stefano Profumo, Tim Tait, and Manoj Kaplinghat** as Cosmic Frontier theory conveners for Snowmass 2021. These three were all coveners of Cosmic Frontier subgroups in the last Snowmass, and they all did excellent jobs and played essential roles in the outcome of that process.

After the intervening years, they remain leaders in the field, and I believe they have the breadth of knowledge and temperament to fill the overall Cosmic Frontier convener role well.