

U.S. Snowmass Process

TRIUMF Science Week
August 18, 2020

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University of Chicago
Chair, Division of Particles and Fields, American Physical Society

Snowmass

Long-term planning exercise for the particle physics community

Its goal is to develop the community's long-term physics aspirations.

to define the most important questions for the field of particle physics
to identify promising opportunities to address them

U.S. Strategic Planning Process for Particle Physics

~year-long process

Snowmass Community-Wide “**Science**” Study

Organized by Division of Particles and Fields (DPF) of APS



Input to P5

~year-long process

P5, Particle Physics Project **Prioritization** Panel

(subpanel of HEPAP, High Energy Physics Advisory Panel for DOE/NSF funding agencies)
formulate a 10-year execution plan (20 year vision) within funding constraints

Particle Physics is not isolated:

Long-Range Plan for Nuclear Science

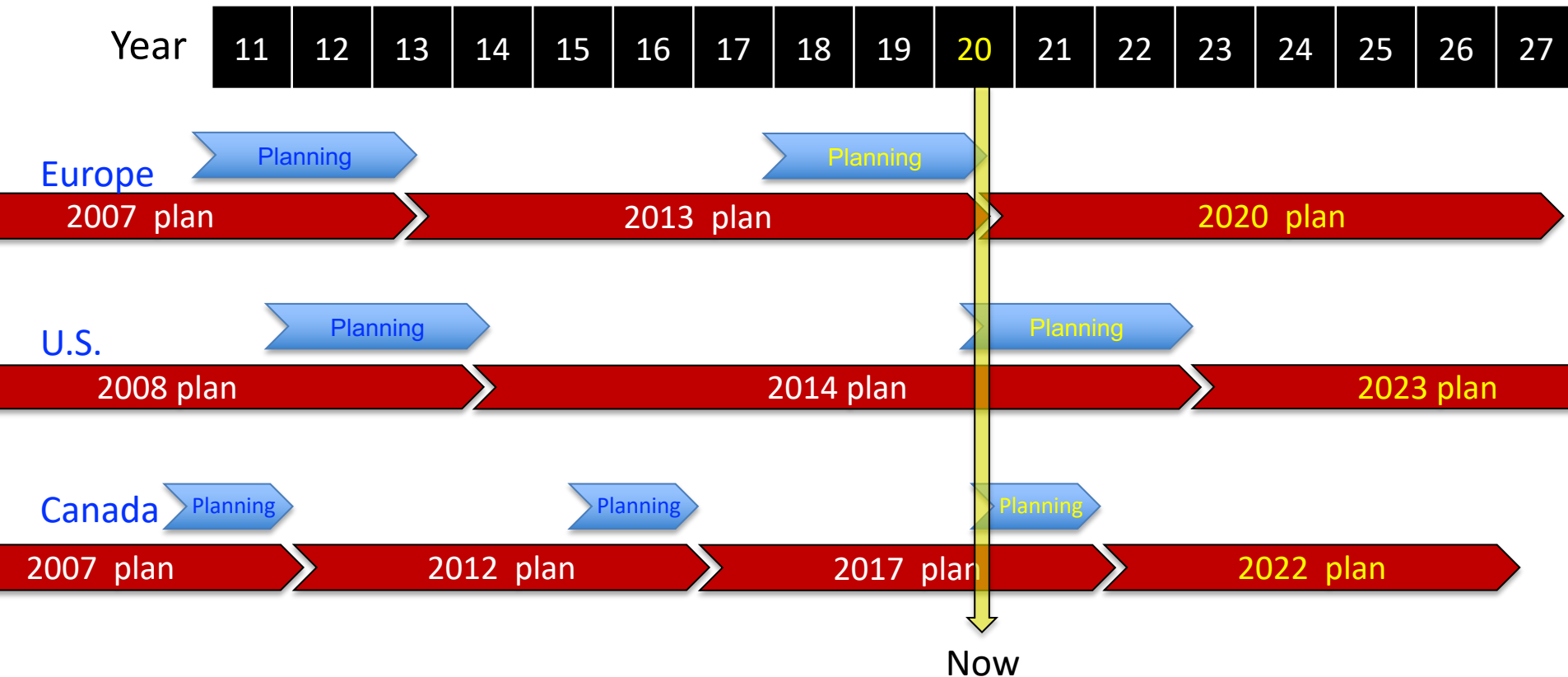
Decadal Survey on Astronomy and Astrophysics

....

Particle Physics is Global

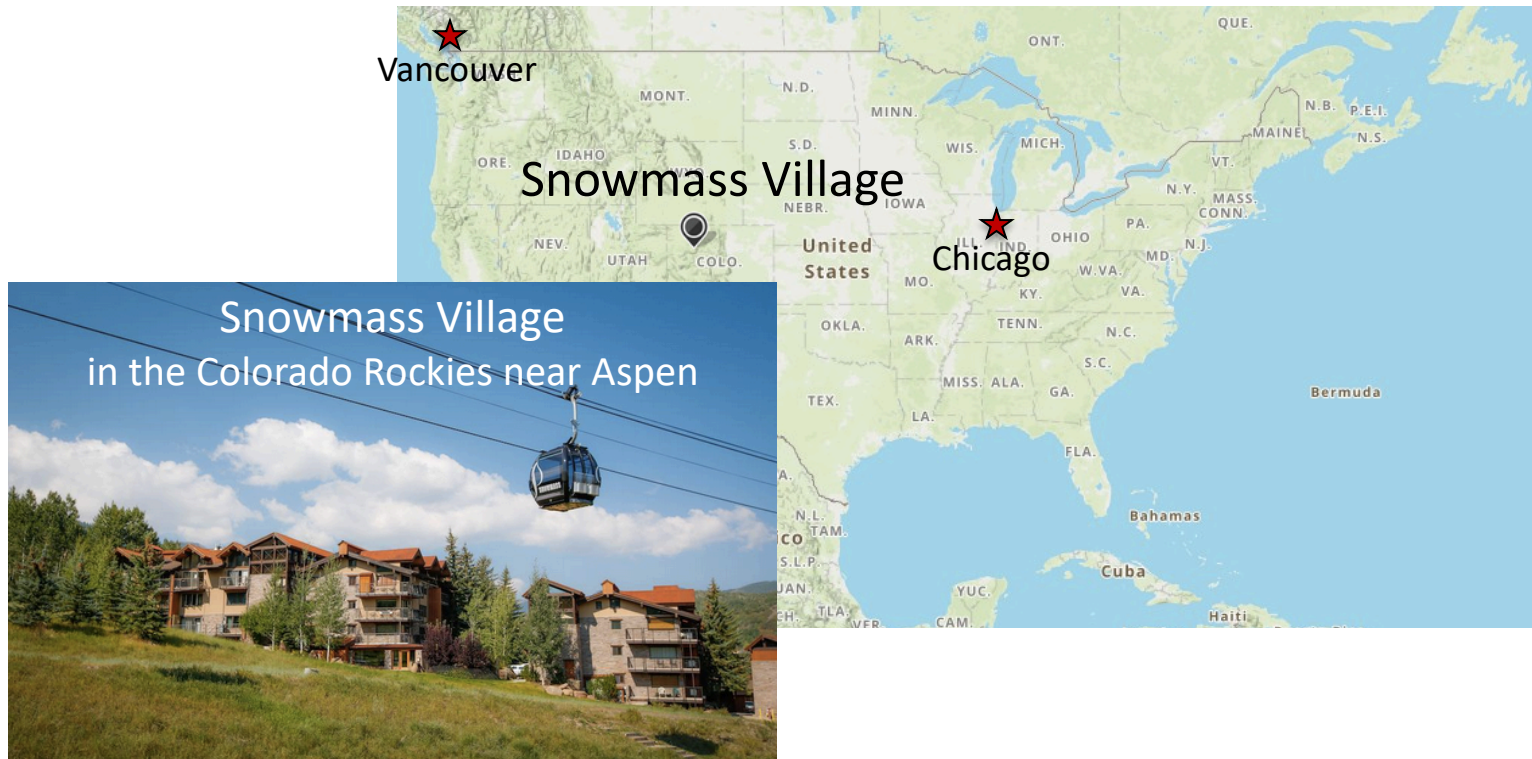
Regional processes

- Europe: 7 years, particle physics (primarily accelerator based)
- U.S.: ~8 years, particle physics (accelerator based and non-accelerator based)
- Canada: 5 years, particle and nuclear physics
- Japan, China, Latin America,



Snowmass: Historical Context

Snowmass Summer Studies: 3 weeks in Summer in Snowmass, Colorado



“~a thousand physicists gathered for three weeks to talk about the future of particle physics in the U.S. — and the rest of the world”

Snowmass: Historical Context

3 weeks in Summer in Snowmass

Snowmass 82 DPF Summer Study on Elementary Particle Physics and Future Facilities, June 28 – July 16

Snowmass 84 DPF Summer Study on the Design and Utilization of Superconducting Super Collider, SSC, June 23 – July 13

Snowmass 86 DPF Summer Study on the Physics of the SSC, June 23 – July 11

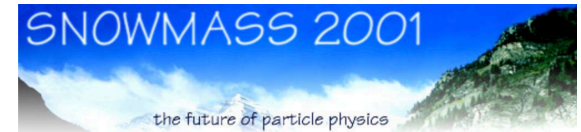
Snowmass 88 DPF Summer Study on High-Energy Physics in the 1990s, June 27 – July 15

Snowmass 90 DPF Summer Study on High-Energy Physics: Research Directions for the Decade, June 25 – July 13

Snowmass 94 DPF Summer Study on High-Energy Physics: Particle and Nuclear Astrophysics and Cosmology
in the Next Millennium, June 29 – July 14

Snowmass 96 DPF/DPB Summer Study on New Directions for High-Energy Physics, June 25 – July 12

Snowmass 2001 DPF/DPB Summer Study on the Future of Particle Physics, June 30 – July 21



Proceedings of Snowmass 2001

**Snowmass Village, Colorado
June 30--July 21**

~1 year long; not in Snowmass

Snowmass 2013

- Organized by DPF
- Summer 2012 – December 2013 (similar in its scope to 2001 but spread out through ~1 year)

Snowmass 2021

- Organized by DPF with strong participation from related fields (DPB, DAP, DGRAV, DNP)
- Spring 2020 – October 2021

Snowmass Topics led to P5 Science Drivers

Snowmass 2013 Report

- Frontiers
 - Energy Frontier
 - Intensity Frontier
 - Cosmic Frontier
- Cross-Cutting
 - Facilities (Underground and Accelerator)
 - Instrumentation
 - Computing
 - Theory
 - Communication

P5 2014 Report

Five intertwined scientific Drivers were distilled from the results of a yearlong community-wide study:

- Use the Higgs boson as a new tool for discovery
- Pursue the physics associated with neutrino mass
- Identify the new physics of dark matter
- Understand cosmic acceleration: dark energy and inflation
- Explore the unknown: new particles, interactions, and physical principles



29 recommendations !!

Snowmass 2013 + P5 2014 has been very successful !!

P5 2014 Report

- Support a program of projects of all scales (large, medium, small), new ideas & developments
- Accelerator science / R&D, instrumentation R&D, computing / software; next gen. education and training

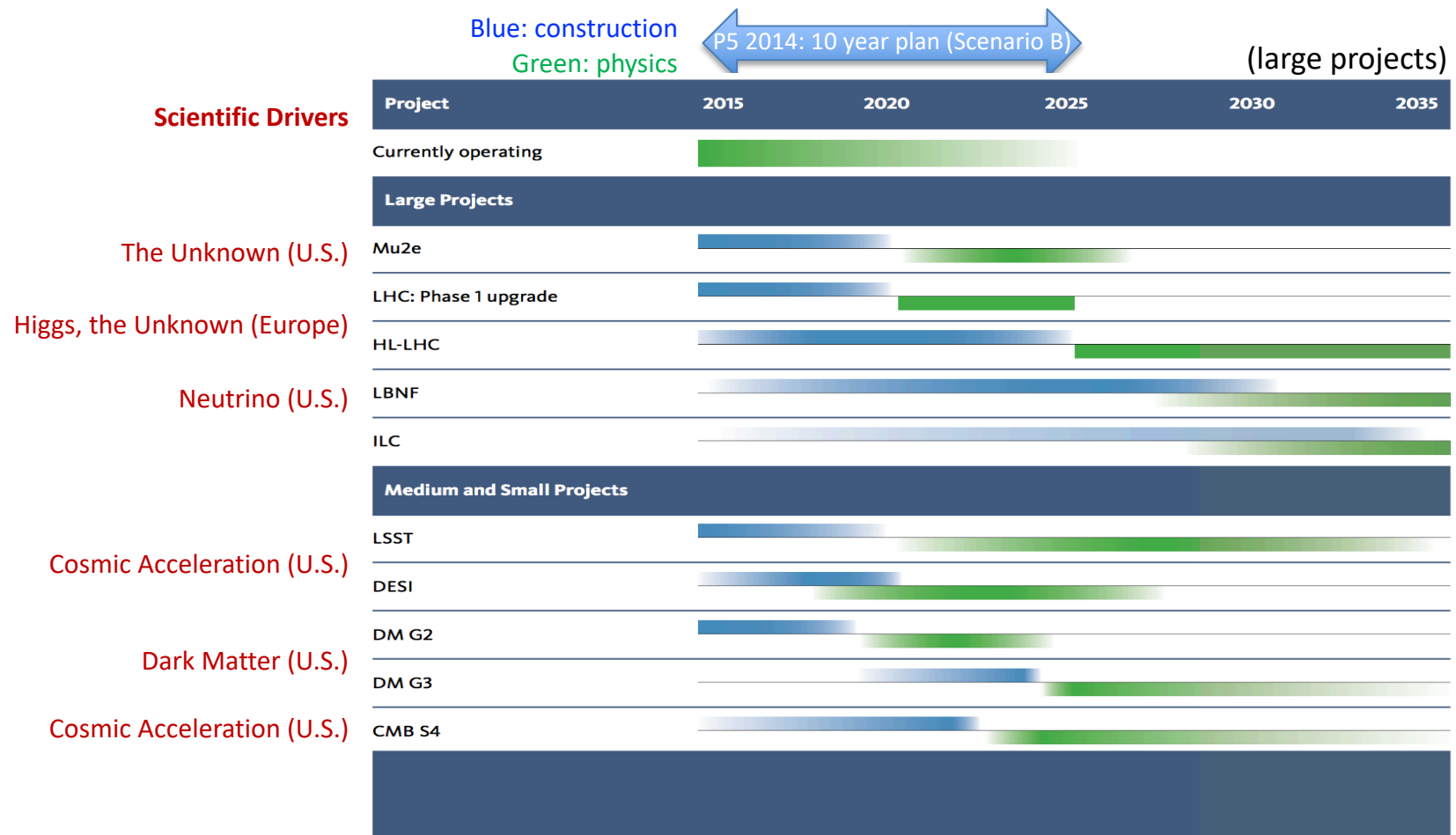


FIGURE 1 Approximate construction (blue; above line) and expected physics (green; below line) profiles for the recommended major projects, grouped by size (Large [$> \$200M$] in the upper section, Medium and Small [$\leq \$200M$] in the lower section), shown for Scenario B. The LHC: Phase 1 upgrade is a Medium project, but shown next to the HL-LHC for context. The figure does not show the suite of small experiments that will be built and produce new results regularly.

Snowmass 2021

- Successful Snowmass 2013 is our guide!
 - Implement lessons learned from Snowmass 2013
- Snowmass 2021: Ten Frontiers
 - Energy Frontier
 - Frontiers in Neutrino Physics
 - Frontiers in Rare Processes & Precision Measurements
 - Cosmic Frontier
 - Theory Frontier
 - Accelerator Frontier
 - Underground Facilities and Infrastructure Frontier
 - Instrumentation Frontier
 - Computational Frontier
 - Community Engagement Frontier

Frontiers and Topical Groups

	Energy Frontier	Frontiers in Neutrino Physics	Frontier of Rare Processes & Precision Measurements	Cosmic Frontier	Theory Frontier
1	Higgs Boson properties and couplings	Neutrino Oscillations	Weak Decays of b and c	Dark Matter: Particle-like	String theory, quantum gravity, black holes
2	Higgs Boson as a portal to new physics	Sterile Neutrinos	Strange and Light Quarks	Dark Matter: Wave-like	Effective field theory techniques
3	Heavy flavor and top quark physics	Beyond the SM	Fundamental Physics and Small Experiments	Dark Matter: Cosmic Probes	CFT and formal QFT
4	EW Precision Phys. & constraining new phys.	Neutrinos from Natural Sources	Baryon and Lepton Number Violation	Dark Energy & Cosmic Acceleration: The Modern Universe	Scattering amplitudes
5	Precision QCD	Neutrino Properties	Charged Lepton Flavor Violation	Dark Energy & Cosmic Acceleration: Cosmic Dawn and Before	Lattice gauge theory
6	Hadronic structure and forward QCD	Neutrino Cross Sections	Dark Sector at Low Energies	Dark Energy & Cosmic Acceleration: Complementarity of Probes and New Facilities	Theory techniques for precision physics
7	Heavy Ions	Nuclear Safeguards and Other Applications		Cosmic Probes of Fundamental Physics	Collider phenomenology
8	Model specific explorations	Theory of Neutrino Physics			BSM model building
9	More general explorations	Artificial Neutrino Sources			Astro-particle physics and cosmology
10	Dark Matter at colliders	Neutrino Detectors			Quantum information science
11					Theory of Neutrino Physics

Frontiers and Topical Groups

	Accelerator Frontier	Instrumentation Frontier	Computational Frontier	Underground Facilities and Infrastructure Frontier	Community Engagement Frontier
1	Beam Phys & Accelerator Education	Quantum Sensors	Experimental Algorithm Parallelization	Underground Facilities for Neutrinos	Applications & Industry
2	Accelerators for Neutrinos	Photon Detectors	Theoretical Calculations and Simulation	Underground Facilities for Cosmic Frontier	Career Pipeline & Development
3	Accelerators for EW/Higgs	Solid State Detectors & Tracking	Machine Learning	Underground Detectors	Diversity & Inclusion
4	Multi-TeV Colliders	Trigger and DAQ	Storage and Processing Resource Assess (Facility and Infrastructure R&D)	Supporting Capabilities	Physics Education
5	Accelerators for PBC & Rare Processes	Micro Pattern Gas Detectors	End user Analysis	Synergistic Research	Public Education & Outreach
6	Advanced Accel. Concepts	Calorimetry	Quantum Computing	Integrated Strategy for Underground Facilities and Infrastructure	Public Policy & Government Engagement
7	Accelerator Technology R&D <ul style="list-style-type: none"> • RF • Magnets • Targets & Sources 	Electronics/ASICS	Reinterpretation and Long-Term Preservation of Data and Code		
8		Noble Elements			
9		Cross Cutting and System Integration			

> 40 liaisons for cross-cutting areas between Frontier Groups and Topical Groups

Create a transparent and inclusive process

- DPF Executive Committee + DPF Program Committee + DAP (Astro Phys), DNP (Nuclear Phys), DPB (Accelerator Phys), DGRAV (Gravitational Phys) representatives
 - Initial organization work
 - Scope of each Frontier + first draft of subgroups of each Frontier
 - Facilitate convener nominations and decisions
- Nominations for frontier & topical conveners
 - General call: community
- Conveners
 - Balance
 - Nominations: senior/junior; theory/experiment; gender; region; labs/universities
 - International members added (~10% conveners are from foreign institutions)
 - Frontiers
 - 30 conveners for 10 Frontiers
 - Topical groups
 - ~240 conveners for ~80 topical groups

Snowmass Early Careers

- Snowmass is towards a long-term strategic plan (20 years)
 - Voices of early career members are critically important
 - Enrich and strengthen involvement of undergraduates, graduate students, postdocs, junior faculty,
- Organization and Leadership
 - Forming representatives for Snowmass Early Careers
 - Solicited nominations: > 250 nominated!!
 - Key initiatives
 - Snowmass Coordination: Snowmass involvement
 - Diversity, Equity, and Inclusion
 - Survey of the early career membership
 - In-reach: Professional development and building cohesion
 - Long-Term Organization

Snowmass Advisory Group

- DPF Executive Committee

- Chair: Young-Kee Kim
- Chair-Elect: Tao Han
- Vice Chair: Joel Butler
- Past Chair: Prisca Cushman

Steering Group

- Secretary/Treasurer: Mirjam Cvetič
- Councilor: Elizabeth Simmons
- Member-at-Large: Rick Van Kooten
- Member-at-Large: Elizabeth Worcester
- Member-at-Large: Natalia Toro
- Member-at-Large: Andre de Gouvea
- Member-at-Large: Mary Bishai
- Member-at-Large: Lauren Tompkins
- Early Career Member-at-Large: Sara Simon

- Editor and Communication

- Editor – Michael Peskin
- Communication – Bob Bernstein

- Representatives from Related Fields

- Accelerator Physics: Sergei Nagaitsev
- Nuclear Physics: Yury Kolomensky
- Astro Physics: Glennys Farrar
- Gravitational Physics: Gabriela Gonzales

- Representatives from the Int. Community

- Africa / Middle East
 - Azwinndini Muronga, Nelson Mandela Metropolitan Univ, South Africa
- Asia / Pacific
 - Atsuko Ichikawa, Kyoto University, Japan
 - Xinchou Lou, IHEP, China
- **Canada**
 - **Heather Logan, Carleton Univ., Canada**
- Europe / Russia
 - Val Gibson, Cavendish Laboratory, UK
 - Berrie Giebels, CNRS, France
- Latin America
 - Claudio Dib, Universidad Tecnica Federico Santa Maria, Chile

Monitoring the progress to make sure that all is moving forward smoothly to achieve the goals of the planning exercise

Snowmass Coordination Team

27 Advisory Group members (including 8 Steering Group members)

30 Conveners for 10 Frontier Groups

~240 Conveners for ~80 Topical Groups

42 liaisons for cross-cutting areas between Frontier Groups and Topical Groups

~30 representatives of Early Careers at a given time

~40 LOC members for 2020 Community Planning Meeting and 2021 Community Summer Study

~400 People in the Coordination Team

Equity, Diversity and Inclusion

- DPF Ethics Task Force

- The Snowmass process is a dynamic exchange of ideas across a large swath of the community, taking place in a variety of virtual (e.g., slack, ZOOM meetings/workshops) and in-person formats.
- Community members must feel safe and supported in engaging in all exchanges.
- DPF Ethics Task Force

- Formed in April 2020



- Activities

- Produced core principles and community guidelines aimed at all facets of Snowmass process
- Is instituting a moderator process to address concerns as they arise on slack
- Will educate our community about microaggressions and proactively work to provide a supportive environment.

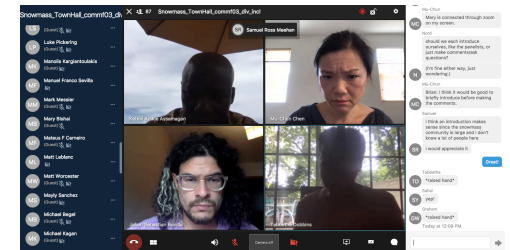
- Snowmass Diversity & Inclusion Topical Group

- Bi-weekly town hall meetings

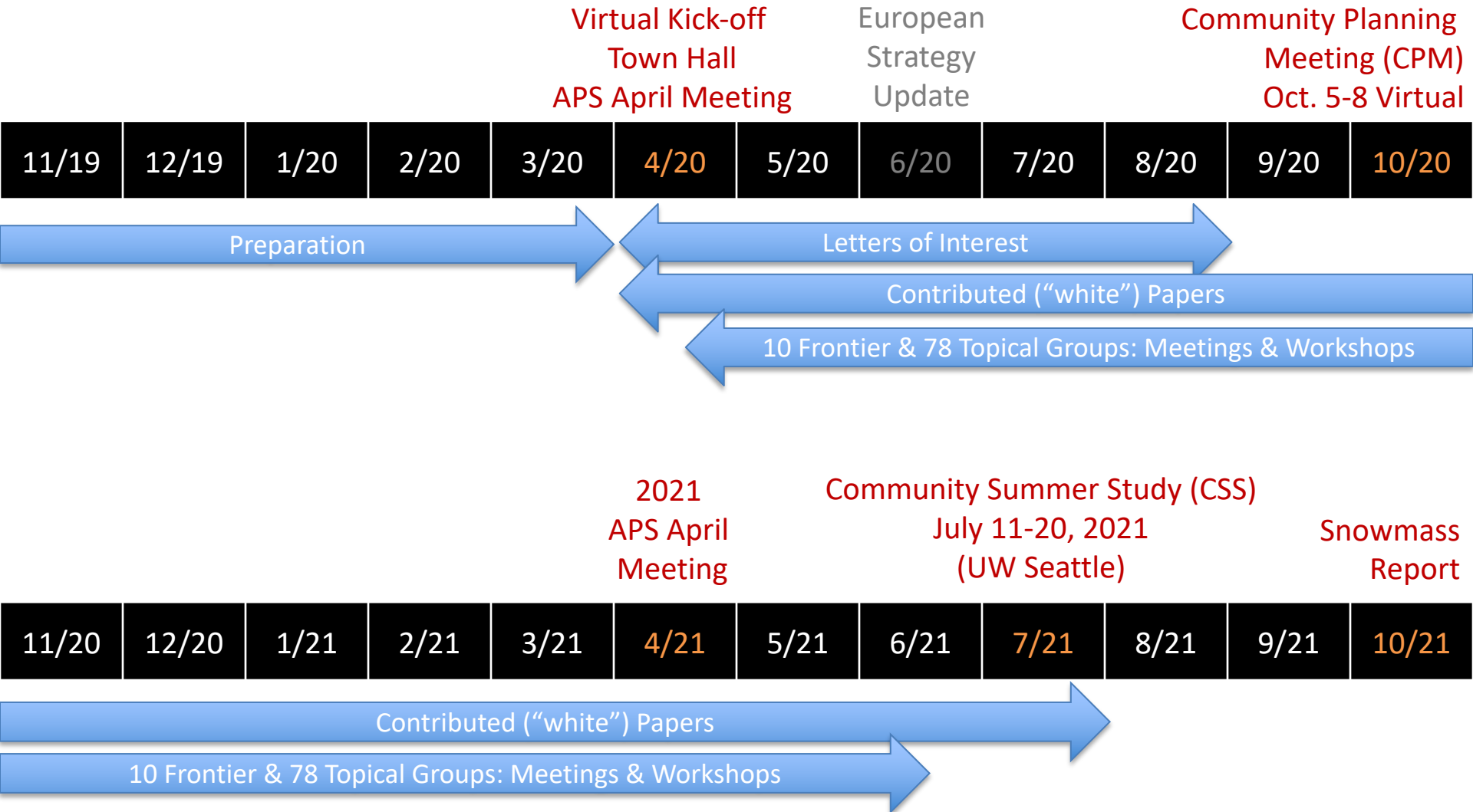
- Accessibility (June 1)
- Racial Justice and Supporting Our Black Community Members (June 15, June 29)
- Code of Conduct and Accountability (July 13)

- Survey on accessibility

- Perspective of how accessibility applies to the Snowmass process (including COVID-19 impacts)



Snowmass Timeline



“Global” Community Contribution

- Letters of Interest (submission : April 1, 2020 – August 31, 2020)
 - Informal documents intended to be useful in the first stages of the Snowmass study
 - Help conveners to prepare the Snowmass Community Planning Meeting (Nov. 2020)
 - Include opinions, interests and proposals that could further be studied
 - Maximum of 2 pages of text, plus relevant bibliography
 - Submission instructions: <https://snowmass21.org/loi>
 - Lol authors are welcome to make a full writeup as a contributed paper (not required)
- Contributed (“white”) Papers (submission : April 1, 2020 – July 31, 2021)
 - Scientific or technical articles on relevant physics / technical topics, and reasoned expressions of physics priorities, including those related to community engagement.
 - Part of Snowmass proceedings (permanent record of Snowmass 2021)
 - Help shape the long-term scientific strategy of particle physics in the U.S.
 - Submission instructions: <https://snowmass21.org/submissions/>
 - Lols are not required in order to submit contributed papers

Communication to the community

- Snowmass Wiki (<https://snowmass21.org/>)
 - One-stop shop
 - Technical liaison: Sergei Chekanov, ANL

The sidebar navigation menu for Snowmass 2021 includes the following sections:

- WELCOME PAGE
- ANNOUNCEMENTS
- SNOWMASS CALENDAR
- ETHICS GUIDELINES
- Organization
 - SNOWMASS ADVISORY GROUP
 - SNOWMASS STEERING GROUP
 - FRONTIER CONVENERS
 - APS DPF SNOWMASS PAGE
 - SNOWMASS EARLY CAREER
- Snowmass Frontiers
 - ENERGY FRONTIER
 - NEUTRINO PHYSICS FRONTIER
 - RARE PROCESSES AND PRECISION
 - COSMIC FRONTIER
 - THEORY FRONTIER
 - ACCELERATOR FRONTIER
 - INSTRUMENTATION FRONTIER
 - COMPUTATIONAL FRONTIER
 - UNDERGROUND FACILITIES
 - COMMUNITY ENGAGEMENT FRONTIER
 - LIAISONS
- Community Contributions
 - LETTERS OF INTEREST
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- SEARCH
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Welcome to Snowmass 2021

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The Particle Physics Community Planning Exercise (a.k.a. "Snowmass") is organized by the Division of Particles and Fields (DPF) of the American Physical Society. Snowmass is a scientific study. It provides an opportunity for the entire particle physics community to come together to identify and document a scientific vision for the future of particle physics in the U.S. and its international partners. The P5 (Particle Physics Project Prioritization Panel) will take the scientific input from Snowmass and develop a strategic plan for U.S. particle physics that can be executed over a 10 year timescale, in the context of a 20-year global vision for the field.

We aim for everyone's voice to be heard. Your contributions and participation are critical for the success of Snowmass and they will naturally occur as part of one or more working groups directed by the conveners. There will be various Town Hall meetings for us to communicate with you and to receive your feedback. You are also welcome to provide input and suggestions on the Slack channel (<https://snowmass2021.slack.com/>). This Snowmass wiki provides news and announcements and has pages dedicated to each frontier. If you are an early career scientist, we encourage you to join the "Snowmass Young" mailing list (snowmass-young@fnal.gov) by emailing to listserv@listserv.fnal.gov with the body of the message "Subscribe snowmass-young YOUR NAME". Agendas and presentations of all Snowmass-related meetings are available via this [Snowmass Indico link](#).

Sincerely,

Young-Kee Kim (DPF Chair), Tao Han (DPF Chair-Elect), Joel Butler (DPF Vice-Chair), Priscilla Cushman (DPF Past Chair)

[Edit](#)

DPF Community Planning Process

Various workshops will be organized by Frontier Conveners between the 2020 Snowmass Planning Meeting (most likely a virtual meeting on Nov. 4 - 6, 2020) and the 2021 Snowmass Summer Study (July 11 - 20, 2021 at UW Seattle). Workshop locations will be chosen to maximize "inclusiveness" based on accessibility and economic consideration. For all the meetings and workshops, we will make sure that we are inclusive to those who participate remotely and we will have a special session to discuss APS efforts for openness and the importance of open international collaboration.

[Edit](#)

News Highlight

see [Announcements](#) tab on the sidebar for a complete list

News Highlight: Information and Upcoming Events

- European Strategy Update for Particle Physics: Recommendations, Deliberation document
- DPF Statement on Police Violence and Supporting Black Communities
- Monthly Snowmass Newsletter (July 2020)
- Presentations and recording of virtual Town Hall (April 18): <https://indico.fnal.gov/event/23601/>
- Letters of Interest (April 1 - August 31, 2020) - <https://snowmass21.org/loi>
- Contributed Papers (April 1 - July 31, 2021) - <https://snowmass21.org/submissions/>

- Snowmass email
 - snowmass@fnal.gov
 - snowmass-young@fnal.gov
 - Frontier & Topical group mailing lists

Slack Channels

The screenshot shows a Slack channel named #general. A message from mikhaildeeth (8:55 PM) is visible, containing a link to a Google Doc titled "Impact of COVID-19 on HEP Community - input to HEPAP". The message text reads: "Meenakshi Narain and I were asked by JoAnne Hewett, HEPAP chair, to prepare a community survey on the impacts of COVID-19 on your work, career and life. You can find a link to the survey here: COVID-19 HEPAP Survey. We would like to get as much input as possible, so feel free to forward the link. We will analyze all responses received by July 7. Impact of COVID-19 on HEP Community - input to HEPAP. A short survey of how the COVID-19 pandemic may have impacted your work. Thank you for your input. (28 KB)".

- Monthly Snowmass Newsletter

Monthly Snowmass Newsletter

Monthly Snowmass Newsletter

June 2020

Organization and activities of S direct you to various pages incl frontier pages with organizati groups, and [core principles ar](#) encourage community member and to submit [Letters-of-Intere:](#)

Energy Frontier

The Energy Frontier is organize Standard Model physics. Conve place. The topical groups have communication channels. A vir The meeting focused on phys contributions, as well as overall introductory presentation from

Monthly Snowmass Newsletter

July 2020

Organization and activities of Snowmass 2021 are available on the [Snowmass wiki page](#). This page will direct you to various pages including the [calendar page](#) with schedules of workshops and meetings, the frontier pages with organization, activities, listserv mailing lists and Slack channels of frontier and topical groups, and [core principles and community guidelines](#) developed by the DPF Ethics Task Force. We encourage community members to participate in discussions on Slack frontier or topical group channels and to submit [Letters-of-Interest \(LOIs\)](#) and [Contributed Papers](#).

The [Snowmass Steering Group](#) meets weekly and the [Snowmass Advisory Group](#) meets once every four weeks. In addition, the Snowmass Advisory Group, all Frontier Conveners and co-chairs of the Community Planning Meeting (CPM) and the Community Summer Study (CSS) meet once every four weeks.

Snowmass Community Planning Meeting

The CMP 2020 will be a virtual meeting and be open to everyone. The local organizing committee has been formed, and the program committee is being formed. The CMP 2020 will take place early November 2020. A draft agenda with dates will be produced in the next few weeks.

Snowmass Early Career

We had over 250 nominations come in for Snowmass early career leadership! We have reached out to all of the early career leadership nominees and defined the structure, key initiatives, and key tasks for each initiative based on feedback from the early career community and the nominees. Nominees have accepted their nominations in their areas of interest, and are beginning to meet and decide on leadership

Current Activities and Upcoming Events

Frontier / topical groups: regular meetings, kick-off workshops / town hall meetings,

Steering Group (weekly), Advisory Group (monthly)
All Frontier Conveners + Advisory Group (monthly)

Snowmass calendar (Snowmass wiki)

The screenshot shows the left-hand navigation menu of the Snowmass 2021 website. The menu items include: WELCOME PAGE, ANNOUNCEMENTS, SNOWMASS CALENDAR (highlighted with a red box), ETHICS GUIDELINES, Organization, SNOWMASS ADVISORY GROUP, SNOWMASS STEERING GROUP, FRONTIER CONVENERs, APS DPF SNOWMASS PAGE, SNOWMASS EARLY CAREER, Snowmass Frontiers, ENERGY FRONTIER, NEUTRINO PHYSICS FRONTIER, RARE PROCESSES AND PRECISION, COSMIC FRONTIER, THEORY FRONTIER, ACCELERATOR FRONTIER, INSTRUMENTATION FRONTIER, COMPUTATIONAL FRONTIER, UNDERGROUND FACILITIES, COMMUNITY ENGAGEMENT FRONTIER, LIAISONS, Community Contributions, LETTERS OF INTEREST, and CONTRIBUTED PAPERS.

Snowmass Meetings and Workshops

News: [Virtual Snowmass Community Planning Meeting](#): ~4 days during the week of October 5th (Oct. 5-9), 2020, each day schedule with 9am-2pm PDT, 12pm-5pm EDT.

All the agendas and presentations are available at

[Snowmass Indico Site](#)

For individual frontiers, go to the following frontier calendars:

Buttons for individual frontier calendars: Energy Frontier, Neutrino Frontier, Rare Processes and Precision, Cosmic Frontier, Theory Frontier, Accelerator Frontier, Instrumentation Frontier, Computational Frontier, Community Engagement Frontier.

For all frontier-conveners meeting, cross-frontier meetings and advisory group meetings, go to the following calendar:

[General Calendar](#)

Snowmass Community-wide, Frontier-level workshops and Particle Physics Collaboration Meetings, Workshops and Conferences

[Workshop Calendar](#)

Last modified: 1e 2020/08/10 19:03

Frontier-level workshops and town hall meetings

	April 2020	May 2020	June 2020	July 2020	August 2020
SNOWMASS					
Community-Wide Workshop	Apr 18 (TownHall)				
Energy Frontier		May 21 (Kick-Off)		July 20-22 (WS)	
Neutrino Physics Frontier				July 17 (TownHall)	
Rare Processes and Precision				July 28 (Kick-Off)	
Cosmic Frontier					
Theory Frontier				End (TownHall)	
Accelerator Frontier			June 29 (Kick-Off)		
Instrumentation Frontier			June 19 (Kick-Off)		
Computational Frontier					Aug. 10-11 (Kick-Off)
Underground Facilities					
Community Engagement Frontier				July 15 (TownHall)	

In addition,

- Many more topical group meetings / workshops
- There have been some inter-frontier / cross-cutting group meetings / workshops

Snowmass 2021: Conclusion

- We aim for everyone’s voice to be heard: Everyone from international community
- Visit the Snowmass wiki page “often”: One-stop shop <https://snowmass21.org/>
- Snowmass is a community-driven process
 - We welcome any comments, suggestions, and concerns from the community
- Look forward to strong participation from Canadian colleagues!!

Snowmass Timeline

