Update on Snowmass 2021

December 4, 2020
HEPAP meeting

Young-Kee Kim
University of Chicago
Chair, Division of Particles and Fields (DPF), American Physical Society
On behalf of the Snowmass Organization Team

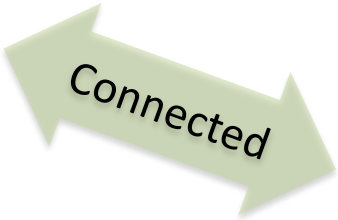
U.S. Strategic Planning Process for Particle Physics

~1.5 year-long process
(last time and this time)

Community-Driven Science Study
(a.k.a. "Snowmass")

Define the most important questions for the field;
Identify promising opportunities to address them

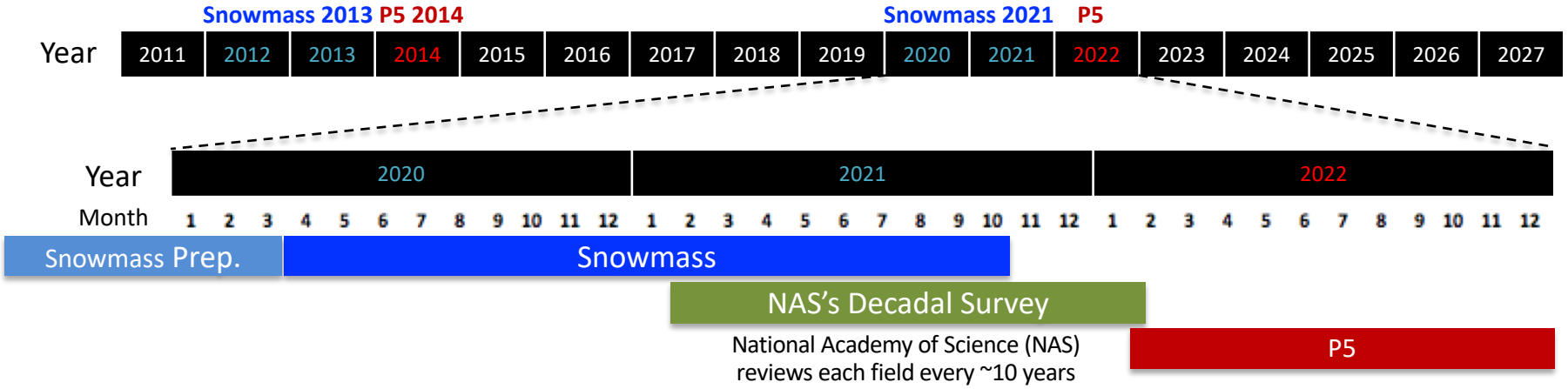
Organized by DPF
w/ related divisions (DPB, DNP, DAP, DGRAV)



Particle Physics is global:
The Snowmass process involves communities and plans from other regions

Particle Physics is not isolated:
The Snowmass process involves communities and plans from related fields (Accelerator, Nuclear, Astro, Gravitational, AMO, …)

U.S. Strategic Planning Process for Particle Physics



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Community-Driven Science Study
(a.k.a. "Snowmass")

Define the most important questions for the field;
Identify promising opportunities to address them

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Input to P5

Topics outside P5 Charge

Project Prioritization Panel ("P5")
Formulate a 10-year execution plan
(with a 20 year vision)
Subpanel of HEPAP for DOE/NSF

Mechanisms to implement:
Being discussed

Topics Outside the P5 Charge

- Potential topics (under the Community Engagement Frontier)
  - Applications & Industry, Career Pipeline & Development, Diversity & Inclusion, Physics Education, Public Education & Outreach, Public Policy & Government Engagement, Environmental Impacts
- Other potential topics depending on what the next P5 will cover
  - HEP Research: Theory and Experiment
  - Accelerator Research
  - R&D for Enabling Technologies for HEP: Accelerators, Detectors, Computing
- P5 Charge
  - The 2014 P5 was focused and successful.
  - We may not want to make the new P5 Charge too broad.
- Potential mechanisms to implement
  - Sub-subpanels under P5
  - Separate subpanels (but ensure to avoid the time lag: e.g., aligning the R&D program of enabling technologies with P5 priority projects)
  - Community-driven panels (e.g., some of Community Engagement Frontier topics)

Snowmass Advisory Group

Steering Group

DPF Executive Committee

(2020)
- Chair: Young-Kee Kim
- Chair-Elect: Tao Han
- Vice Chair: Joel Butler
- Past Chair: Prisca Cushman

(2021)
- Chair: Tao Han
- Chair-Elect: Joel Butler
- Vice Chair: Sekhar Chivukula
- Past Chair: Young-Kee Kim
- Ex-Officio: Prisca Cushman

Representatives from Related Divisions

- DPB (accelerator physics): Sergei Nagaitsev
- DNP (nuclear physics): Yury Kolomensky
- DAP (astro physics): Glennys Farrar
- DGRAV (gravitational phys.): Gabriela Gonzales

- Secretary/Treasurer: Mirjam Cvetic
- Councilor: Elizabeth Simmons
- Member-at-Large: Rick Van Kooten (2020) → Mayly Sanches (2021)
- Member-at-Large: Elizabeth Worcester (2020) → Gordon Watts (2021)
- 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 (2020) → Julia Gonski (2021)

Editor and Communication Liaison

- Editor – Michael Peskin
- Communication – Bob Bernstein

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 University, Canada
- Europe
  - Val Gibson, Cavendish Laboratory, UK
  - Berrie Giebels, CNRS, France
- Latin America
  - Claudio Dib, Universidad Tecnica Federico Santa Maria, Chile

Steering group meets weekly

Advisory group meets once every 4 weeks

Monitoring the progress to make sure that all is moving forward smoothly to achieve the goals of community study

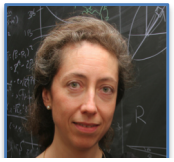
Transparent and Inclusive Process

- DPF Executive Committee + DPF Program Committee + Representatives of Related Divisions (DAP, DNP, DPB, DGRAV)
  - Initial organization work
  - Scope of each Frontier + first draft of topical groups of each Frontier
  - Facilitate convener nominations
- General call for frontier & topical convener nominations
  - Closed November 15, 2019
  - Self-nominated, by peer, or by a small group
- Frontier co-conveners (formed in January 2020)
  - Chosen by elected representatives (DPF EC + Chair-line of DAP, DNP, DPB, DGRAV)
  - Based on balance: senior/junior; theory/experiment; gender; region; labs/universities
  - ~3 co-conveners for each of the 10 Frontiers
- Topical groups and topical group conveners (formed in April 2020)
  - 6-10 topical groups for each frontier: ~80 topical groups in total
  - ~3 co-conveners for each topical group: topical group conveners from all the compiled nominations + others (e.g. international members), endorsed by the Steering Group
- Liaisons (formed Spring and Summer 2020)
  - Cross cutting areas

Frontier Conveners

Energy Frontier


Meenakshi Narain
(Brown U)


Laura Reina
(FSU)


Alessandro Tricoli
(BNL)

Accelerator Frontier


Steve Gourlay
(LBNL)


Tor Raubenheimer
(SLAC)


Vladimir Shiltsev
(FNAL)

Frontiers in Neutrinos


Patrick Huber
(Virginia Tech)


Kate Scholberg
(Duke U.)


Elizabeth Worcester
(BNL)

Instrumentation Frontier


Phil Barbeau
(Duke)


Petra Merkel
(FNAL)


Jinlong Zhang
(ANL)

Frontiers in Rare & Precision


Marina Artuso
(Syracuse U.)

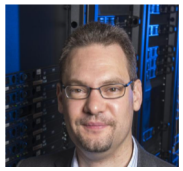

Alexey Petrov
(Wayne State U.)


Bob Bernstein
(FNAL)

Computational Frontier


Steven Gottlieb
(Indiana U.)


Ben Nachman
(LBNL)


Oliver Gutsche
(FNAL)

Cosmic Frontier


Aaron Chou
(Fermilab)


Marcelle Soares-Santos
(U.Michigan)


Tim Tait
(UC Irvine)

Underground Facilities and Infrastructure Frontier


Laura Baudis
(U. Zurich)


Jeter Hall
(SNOLAB)


Kevin Lesko
(LBNL)


John Orrell
(PNNL)

Theory Frontier


Nathaniel Craig
(UCSB)


Csaba Csaki
(Cornell)


Aida El-Khadra
(UIUC)

Community Engagement Frontier


Kétévi Assamagan
(BNL)


Breese Quinn
(Mississippi)

Frontiers and Topical Groups

10 Frontiers	80 Topical Groups
Energy Frontier	Higgs Boson properties and couplings, Higgs Boson as a portal to new physics, He…nd top quark physics, EW Precision Phys. & constraining new phys., Precision QCD, Hadronic structu…, Heavy Ions, Model specific explorations, More general explorations, Dark Matter at coll…
Frontiers in Neutrino Physics	Neutrino Oscillations, Sterile Neutrinos, Beyond the SM N…no Properties, Neutrino Cross Sections, Nuclear Safeguards and Other Appli…tificial Neutrino Sources, Neutrino Detectors
Frontiers in Rare Processes & Precision Measurements	Weak Decays of b and c, Strange…s and Small Experiments. Baryon and Lepton Number Violation, Charg… at Low Energies, Hadron spectroscopy
Cosmic Frontier	Dark Matter: P…ark Matter: Cosmic Probes, Dark Energy & Cosmic Acceleration: The Modern…leration: Cosmic Dawn &…e, Dark Energy & Cosmic Acceleration: …acilities
Theory Frontier	…ity, black holes, Effective…T and formal QFT, Scattering amplitudes, …heory techniques for pr…ology, BSM model building, Astro- …s and cosmology, Quantu…Physics
Accelerator	…am Physics and Accelerat…r Electroweak and Higgs Physics, Multi-TeV Colliders, A…dvanced Accelerator Concepts, Accelerator Te…
Instrumentation Frontier	Qua…acking, Trigger and DAQ, Micro Pattern Gas Detectors, …tting and System Integration, Radio Detection
Computational Frontier	E…retical Calculations and Simulation, Machine Learning, Storage and pro…d Infrastructure R&D), End user analysis
Underground Facilities and Infrastructure Frontier	Under…es for Neutrinos, Underground Facilities for Cosmic Frontier, Underground Detectors
Community Engagement Frontier	Applications & Industry, Career Pipeline & Development, Diversity & Inclusion, Physics Education, Public Education & Outreach, Public Policy & Government Engagement

30 Frontier conveners, ~250 Topical Group conveners, >40 Inter-Frontier Liaisons, ~25 Early Career Liaisons

All efforts are already underway:

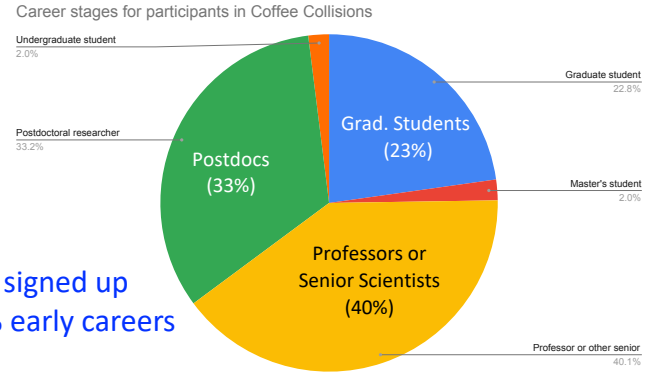
- Frontier conveners (since January 2020)
- TG conveners (since April 2020)
- Early Careers (since June 2020)

Snowmass Early Careers

- The Snowmass 2021 process is towards a long-term strategic plan
  - Voices of early career members are critically important
  - Undergrad & grad students; postdocs, early-career faculty, engineers (<~10 years post-PhD)
- Representatives
  - Based on > 250 nominations*!!*
- Goals
  - Snowmass: Represent early careers and promote their engagement
    - Snowmass coordination: 2-3 Liaisons per Frontier
  - Build a long-term HEP early career community
    - Survey of the early career membership
    - In-reach: Professional development, …
    - EDI (diversity, equity, and inclusion)
    - Long-term organization
- Snowmass Early Careers Wiki
  - https://snowmass21.org/start/young

In-reach Initiatives:

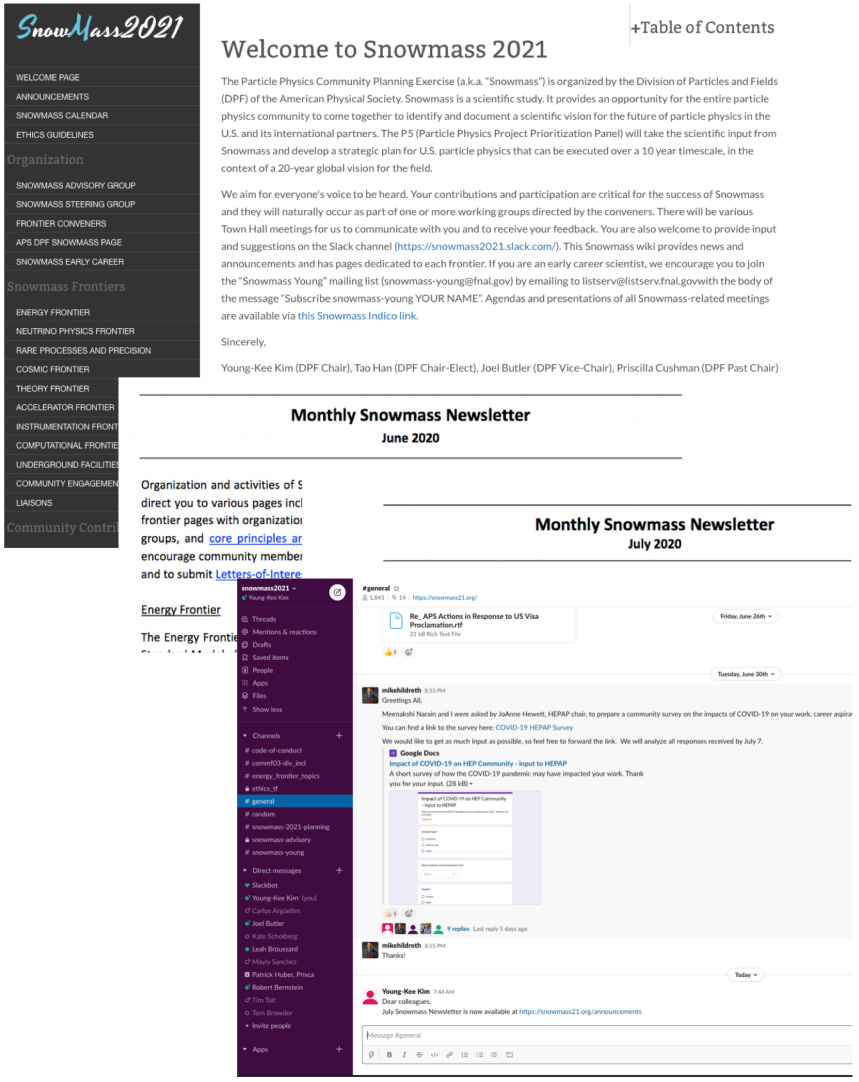
- Monthly big questions colloquium series
- "Coffee Collisions" to create new connections across career stages via for 1-on-1 meetings



~200 signed up
~60% early careers

Snowmass Communication

- Wiki (https://snowmass21.org/)
  - One-stop shop
    - Organization
    - Frontier/TG activities
    - Early Careers
    - Calendars (workshops, meetings, ..)
    - News and Announcements
    - Community Contributions
    - ….
- Monthly Snowmass Newsletter
- Slack channels (> 2,000 participants)
- Email
  - snowmass@fnal.gov
  - snowmass-young@fnal.gov
  - Frontier group mailing lists
  - Topical group mailing lists
  - …



Snowmass Ethics

- Snowmass: dynamic exchange of ideas across a large swath of the community in a variety of formats including slack channels, meetings, and workshops.
- All community should feel safe and supported in engaging in all exchanges.

- DPF Ethics Task Force formed in April 2020
  - Drafted DPF Core Principles and Community Guidelines
  - CP&CG Response Team (names in bold) for responding to reports of violations
  - Task Force members
    - **Ketevi Assamagan**
    - Carla Bonifazi
    - Mu-Chun Chen
    - Prisca Cushman
    - **Andre de Gouvea**
    - Young-Kee Kim (ex-officio)
    - Samuel Meehan
    - **Sara Simon**
    - **Lauren Tompkins (chair)**
    - **Elizabeth Worcester**

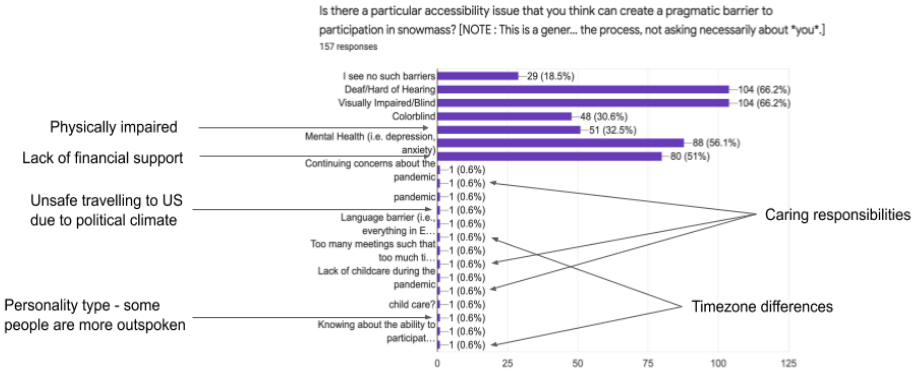
- DPF Ethics Advisory Committee (standing committee) formed in Nov. 2020
  - Inaugural Committee members (Nov. 2020 – Oct. 2022)
    - Kétévi Assamagan
    - Bill Barletta
    - Melissa Franklin
    - Maria Elena Monzani
    - Pavel Fileviez Perez
    - Amber Roepe
    - Pekka Sinervo
    - Ruth Van de Water
    - Jeremy Wolcott

Snowmass Ethics

Accessibility Survey by Comm. Engagement Frontier's D&I TG (157 responses / >2,000 slack members)

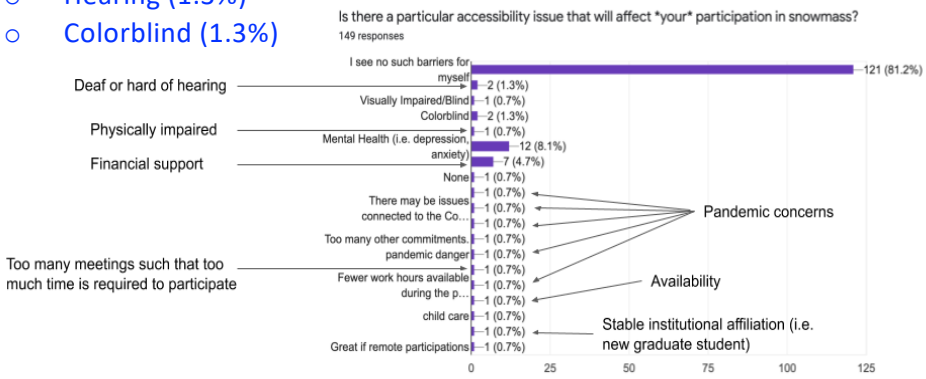
To ensure the equity of all those who wish to participate in the Snowmass process is supported

81.5% think that there are barriers

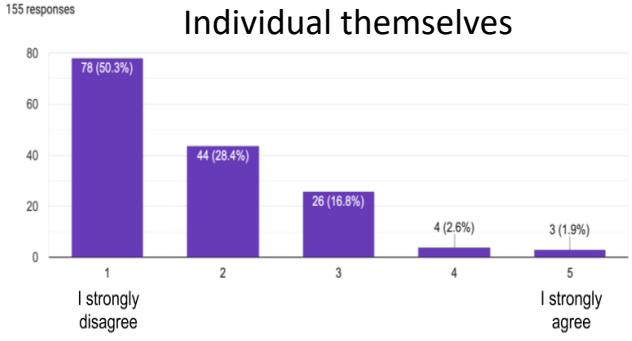


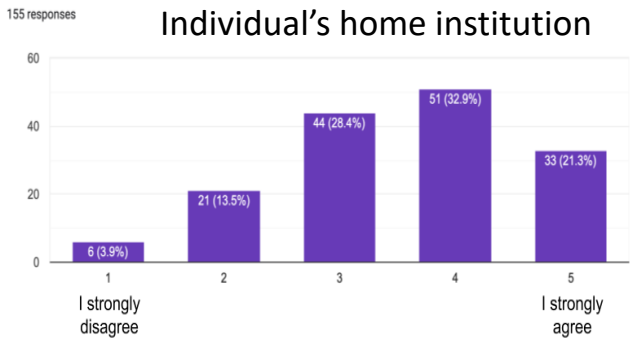
19% said that barriers exist for them

- Mental (8%)
- Financial (5%)
- Hearing (1.3%)
- Colorblind (1.3%)



Who's responsible for the support?





Similar results

- Home Institution
- APS and/or DPF
- Host institute for international events

Snowmass Ethics

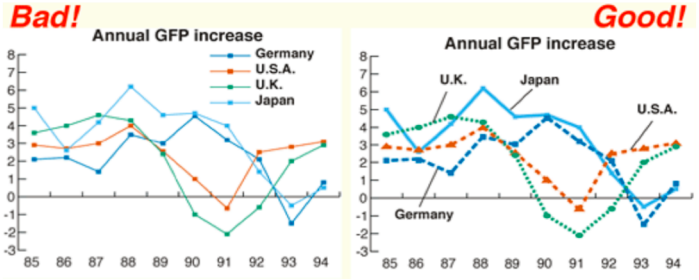
Accessibility Survey by Comm. Engagement Frontier's D&I TG (157 responses / >2,000 slack members)

To ensure the equity of all those who wish to participate in the Snowmass process is supported

- Some can be dealt with by behavioral modifications while others require financial investment
  - Physical/mobility
    - Create accessible paths between conf. activity sites
  - Visual Impairments/Colorblind
    - Make colorblind-friendly figures and presentations
    - (https://jfly.uni-koeln.de/color/)
  - Deaf/Hard of Hearing
    - Live captioning
    - Human captioner: < ~1% word error rate

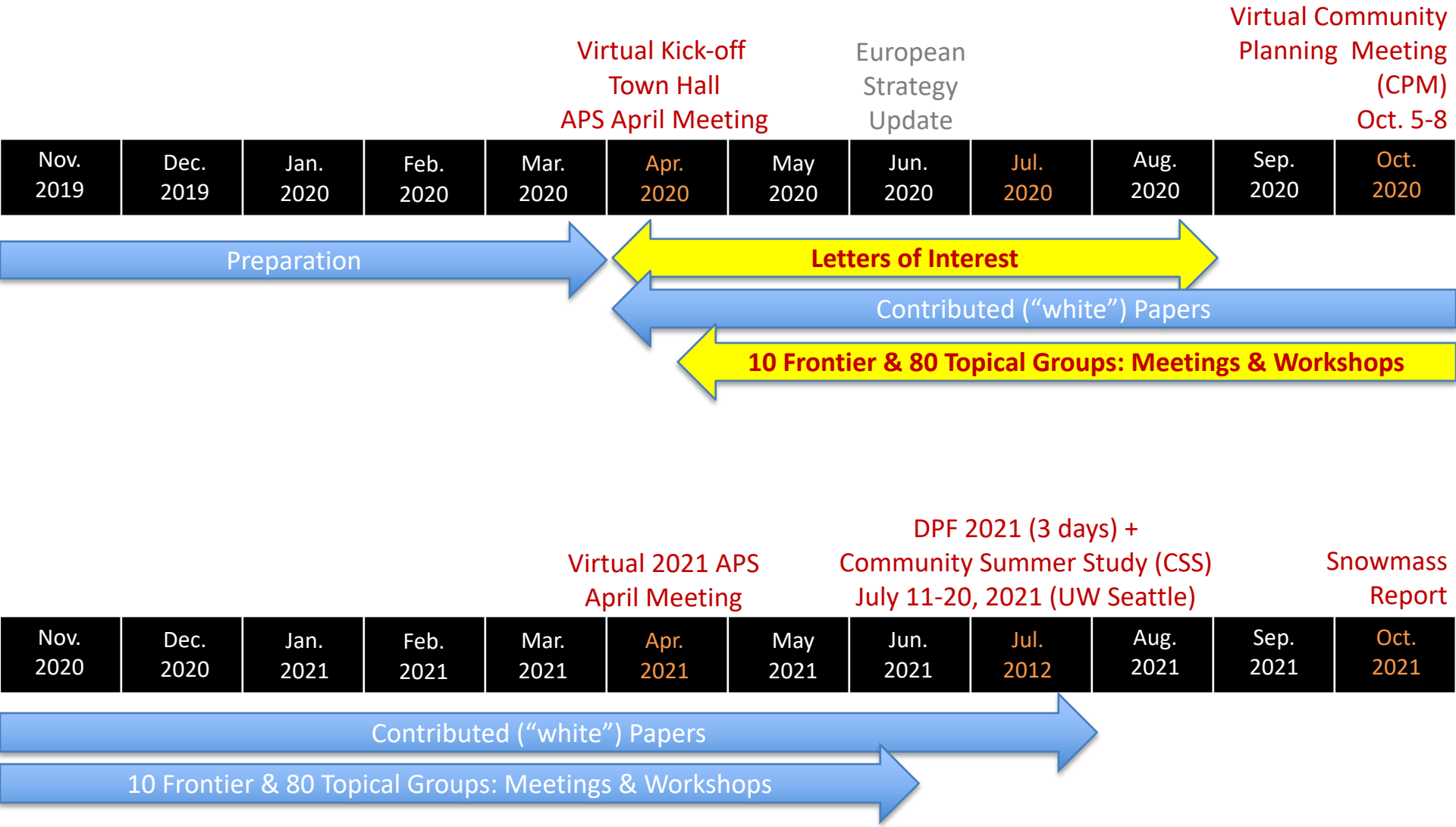
      (Auto caption: ~20% word error rate – not acceptable)
  - Mental health (due to high volume of meetings and fear of missing out)
    - Create quiet space (peace and solace) – conferences, minimize # meetings, follow the core principles and community guidelines
  - Financial Barriers: travel support of early careers for in-person meetings
  - Care for Others: support of the childcare system for in-person meetings
  - Covid-19 Pandemic
    - Continue to monitor the community by conducting surveys
    - Approach interactions with others with a sense of understanding (similar to mental health issues)

Example of redundantly coded drawings



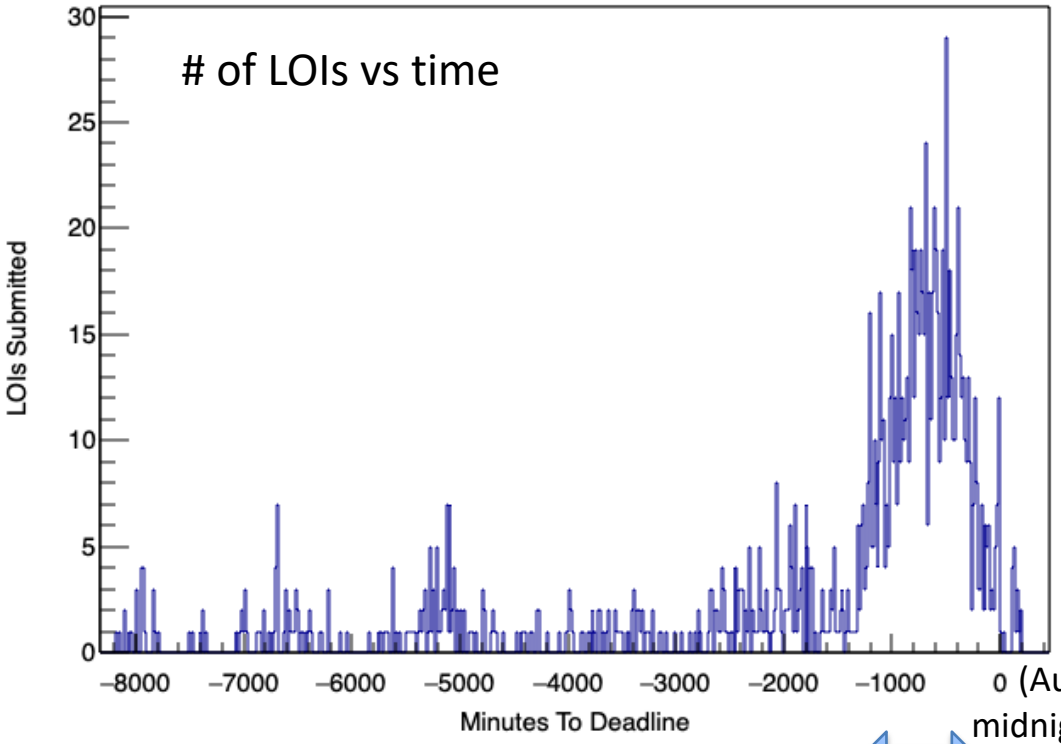
- Implementation: Under Discussions
  - DPF Executive Committee, DPF Ethics Committee, CSS Local Organizing Committee, DOE/NSF/HEPAP

Snowmass Timeline: Activities Through CPM



Letters of Interests

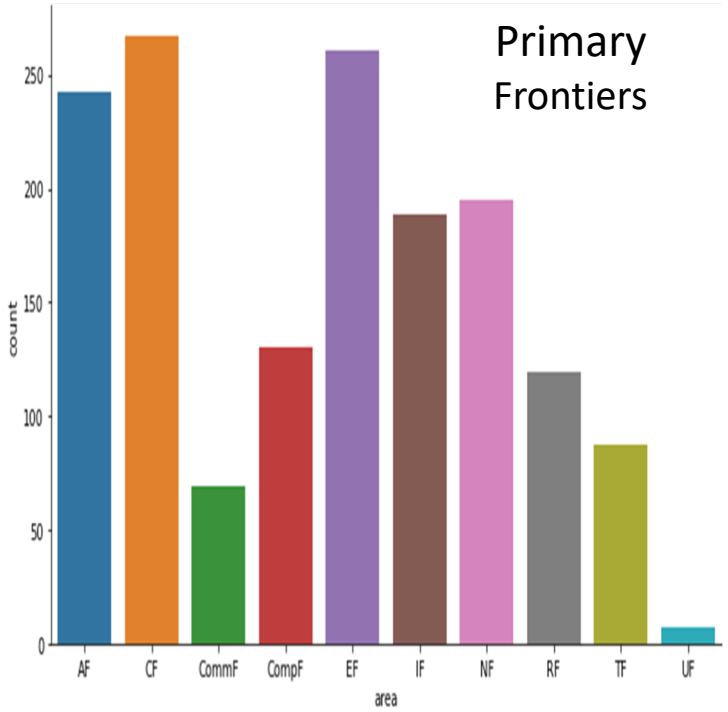
1,574 in total: submitted before August 31, 2020
Many LOIs – multiple frontiers
Frontier + TG conveners: tireless efforts to prepare the CPM using this information (Sept.)



(Credit: Sam Hedges)

(Aug. 31 midnight in Hawaii)

20 hours



(Credit: Gordon Watts)

Snowmass Community Planning Meeting (CPM)

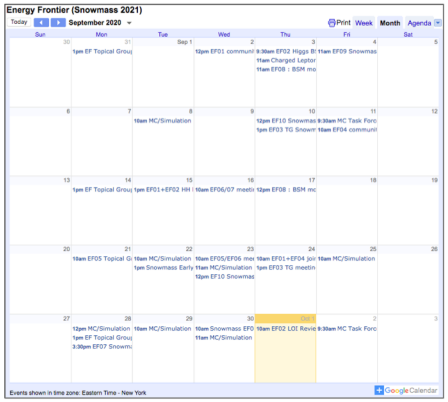
- April 2020 – October 2020 (CPM)
  - Each Frontier and Topical Group: meetings and various workshops since Spring 2020

- CPM's goals
  - Develop plans and steps to take between October 2020 and the Snowmass Community Study in July 2021, leading to a final report in October 2021.

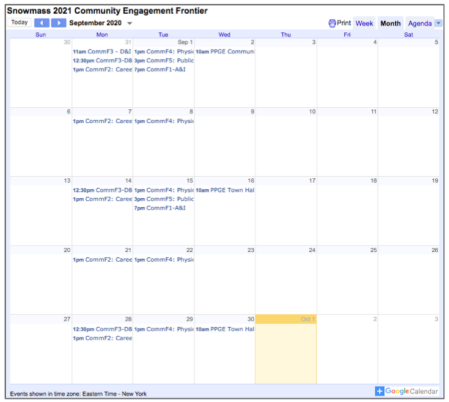
- CPM Plenary Sessions
  - Exciting Physics
  - Plans from other regions and related fields
  - Messages from funding agencies
  - Voices of the community

- CPM Parallel Sessions
  - First opportunity to bring together the community across the field
  - Focus on inter-frontier discussions
  - Establish cross working group connections
  - Identify gaps and areas to focus / to study
  - Brainstorm new ideas

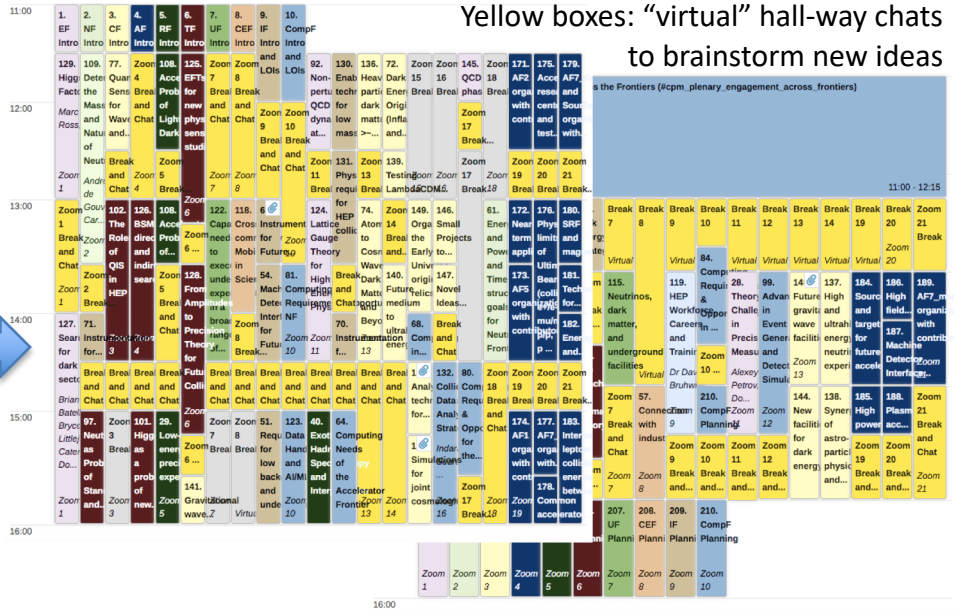
Energy Frontier Calendar (Sept 2020)



Community Engagement Frontier Calendar (Sept 2020)



Yellow boxes: "virtual" hall-way chats to brainstorm new ideas

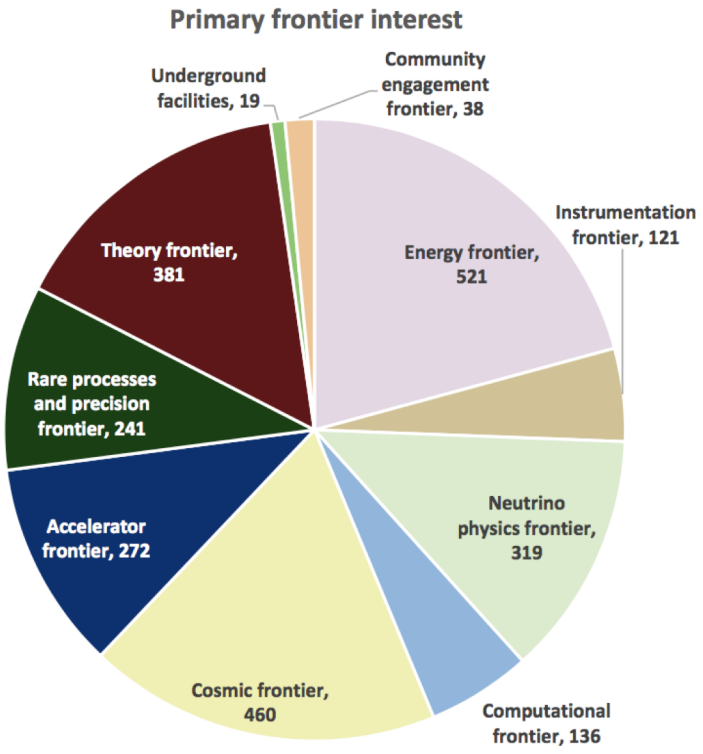


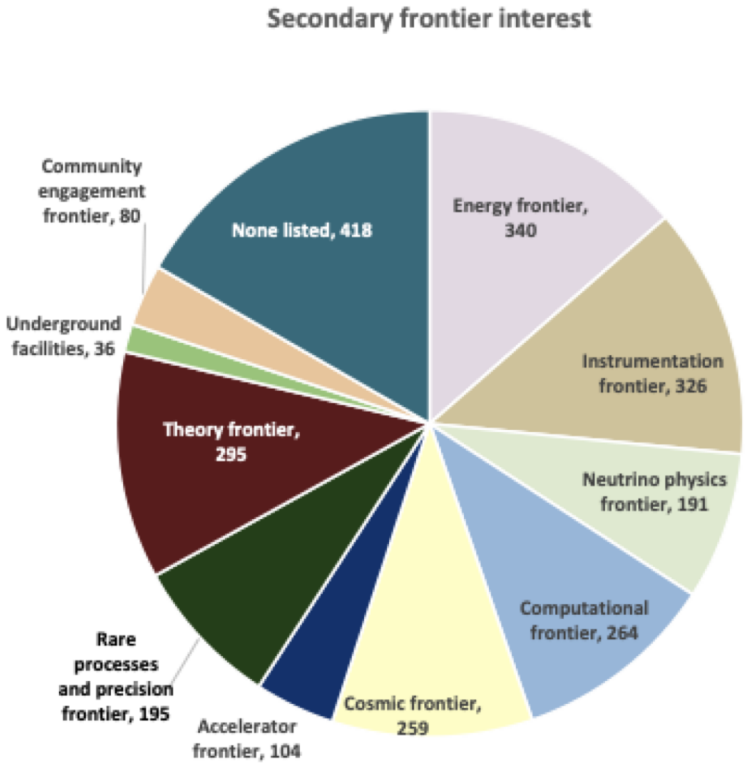
Snowmass Community Planning Meeting (CPM)

~3,000 participants

~650 outside the North America Time Zone

(Note that 11am-4pm U.S. Central time was inconvenient – very inconvenient for many countries)



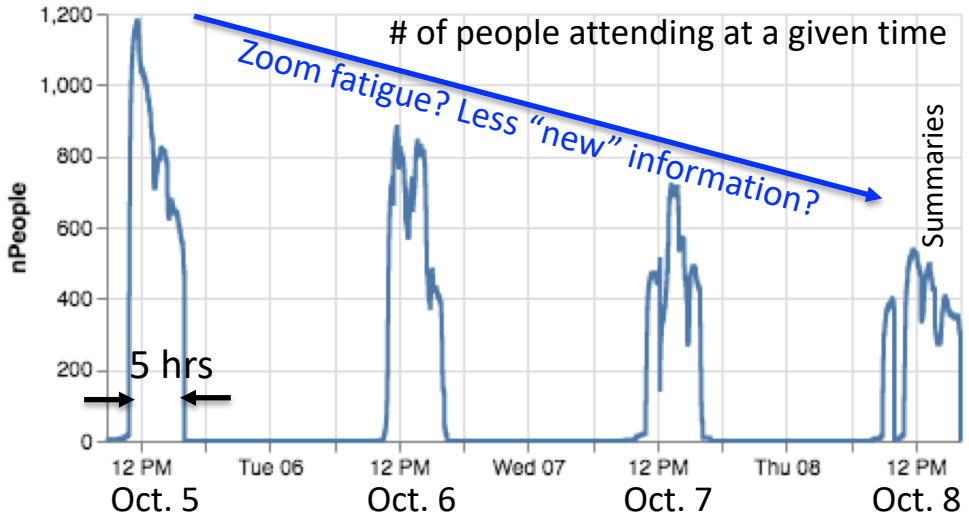


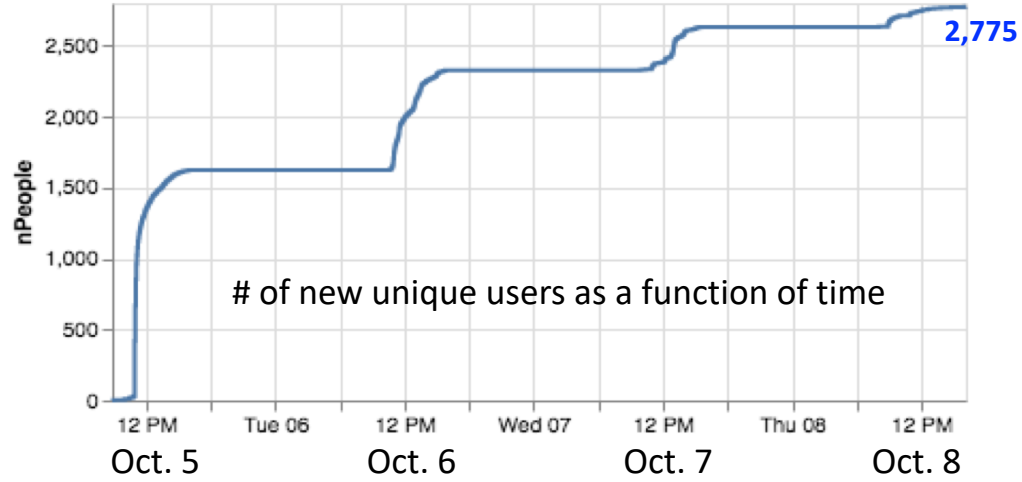
Snowmass Community Planning Meeting (CPM)

[Statistics](#) (2 breakout sessions yet to be added)

Credit: Gordon & Brendan

Time (US Central)	Oct 5 (Mon)	Oct 6 (Tue)	Oct 7 (Wed)	Oct 8 (Thu)
9:00 AM				**Plenary** Future Global Accelerator Facility Panel Discussion *Zoom Webinar*
10:00 AM				
11:00 AM	**Plenary** • Introduction • Strategies and Plans from Other Regions • Strategies and Plans from Other Fields • Remarks from Funding Agencies *Zoom Webinar*	**Frontier Intros** *Zoom Rooms* *(see schedule for details)*	**Plenary** Community Engagement *Zoom Webinar*	**Plenary** • Early Careers Report • Frontier Summary Reports • Closing *Zoom Webinar*
12:00 PM		**Breakouts** *Zoom Rooms* *(see schedule for details)*		
1:00 PM			**Breakouts** *Zoom Rooms* *(see schedule for details)*	
2:00 PM				
3:00 PM	**Plenary** Voices from the Community Town Hall *Zoom Webinar*		**Frontier Planning** *Zoom Rooms* *(see schedule for details)*	
4:00 PM				





Snowmass Community Planning Meeting (CPM)

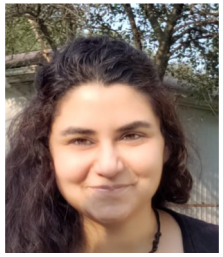
Local Organizing Committee:

Co-chairs

Bo Javatilaka
Brendan Kiburg
Fermilab

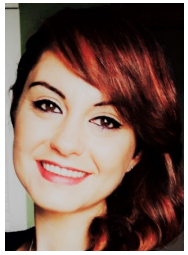


Jonathan Asaadi
UT, Arlington


Saptaparna
Bhattacharya,NW


Zoltan Gecse
Fermilab


Erica Snider
Fermilab


Tiziana Spina
Fermilab


Yuanyuan Zhang
Fermilab


Gordon Watts
UW Seattle

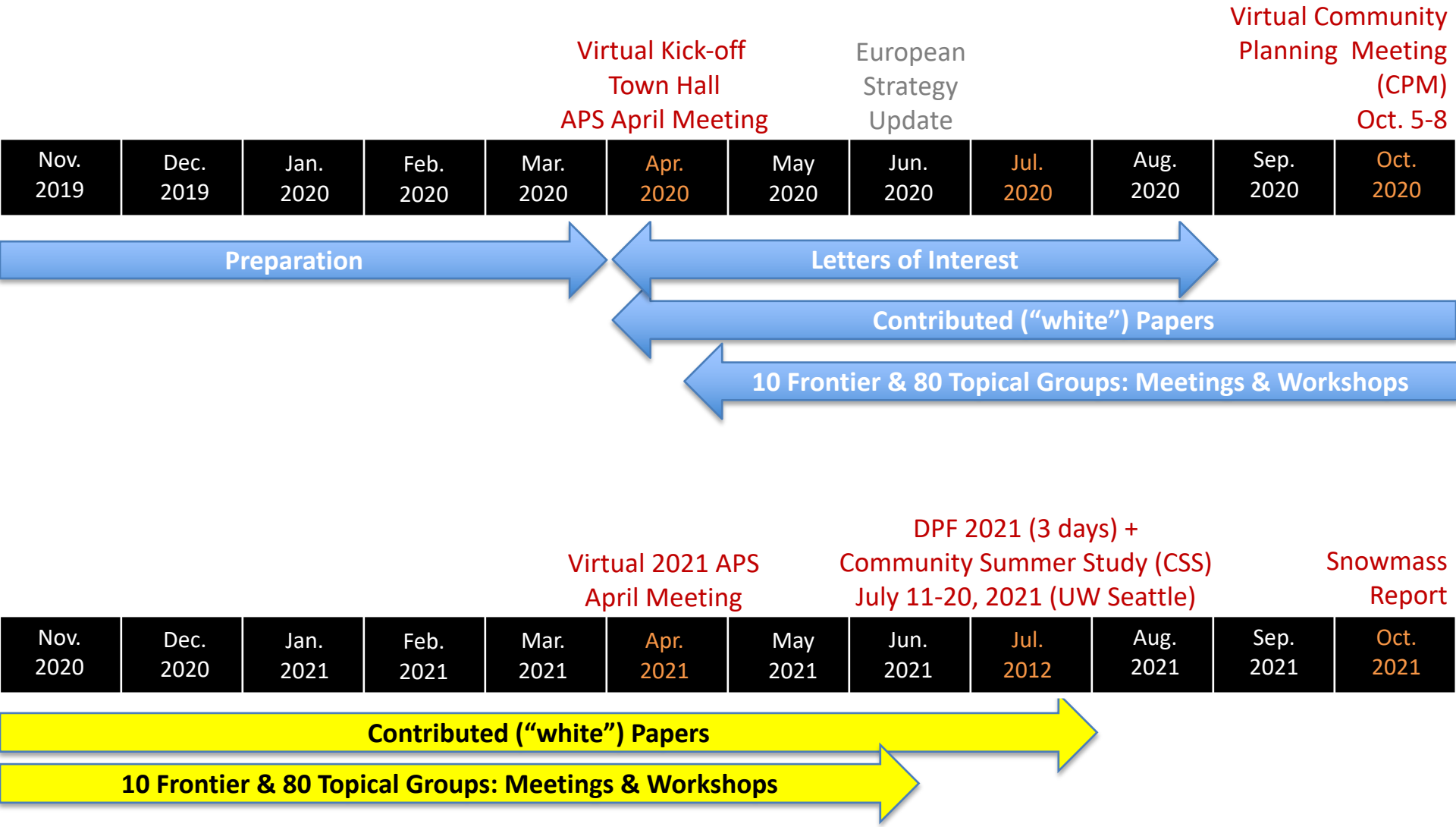

Shih-Chieh Hsu
UW Seattle

(Co-chairs of 2021 CSS)

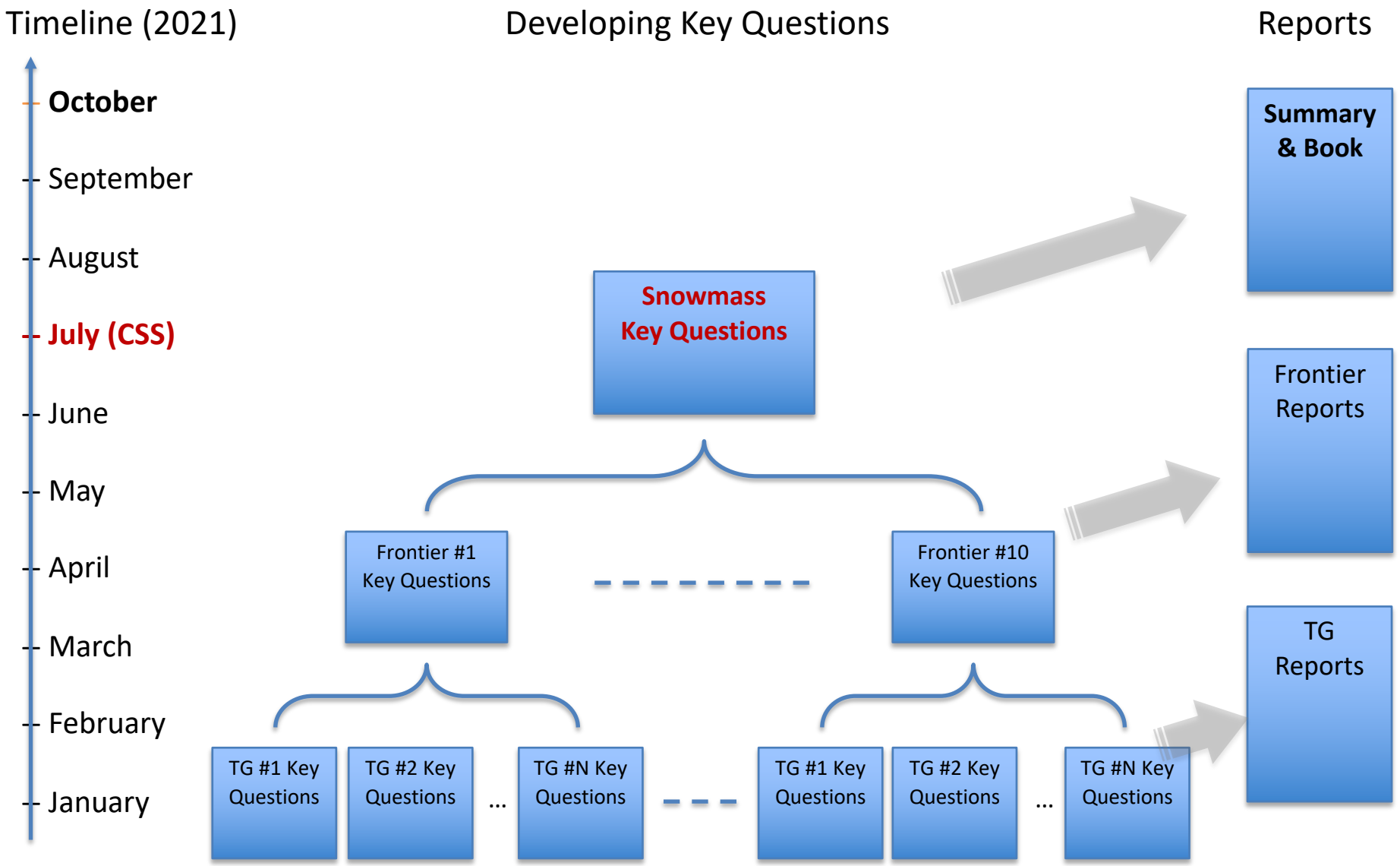
Program Committee:

- Steering Group
  - Young-Kee Kim (chair), Tao Han, Joel Butler , Priscilla Cushman
  - Glennys Farrar, Gabriela Gonzales, Yury Kolomensky, Sergei Nagaitsev
- Frontier Representatives
  - Laura Reina, Patrick Huber, Marina Artuso, Aaron Chou, Aida El-Khadra, Tor Raubenheimer, Jinlong Zhang, Oliver Gutsche, John, Orrell, Breese Quinn
- Early Careers
  - Vishvas Pandey (postdoc), Joshua Barrow (graduate student)
- Co-chairs of CPM Local Organizing Committee
  - Bo Jayatilaka, Brendan Kiburg

Snowmass Timeline: Next Steps



Next Steps: Snowmass Timeline & Process (Preliminary)



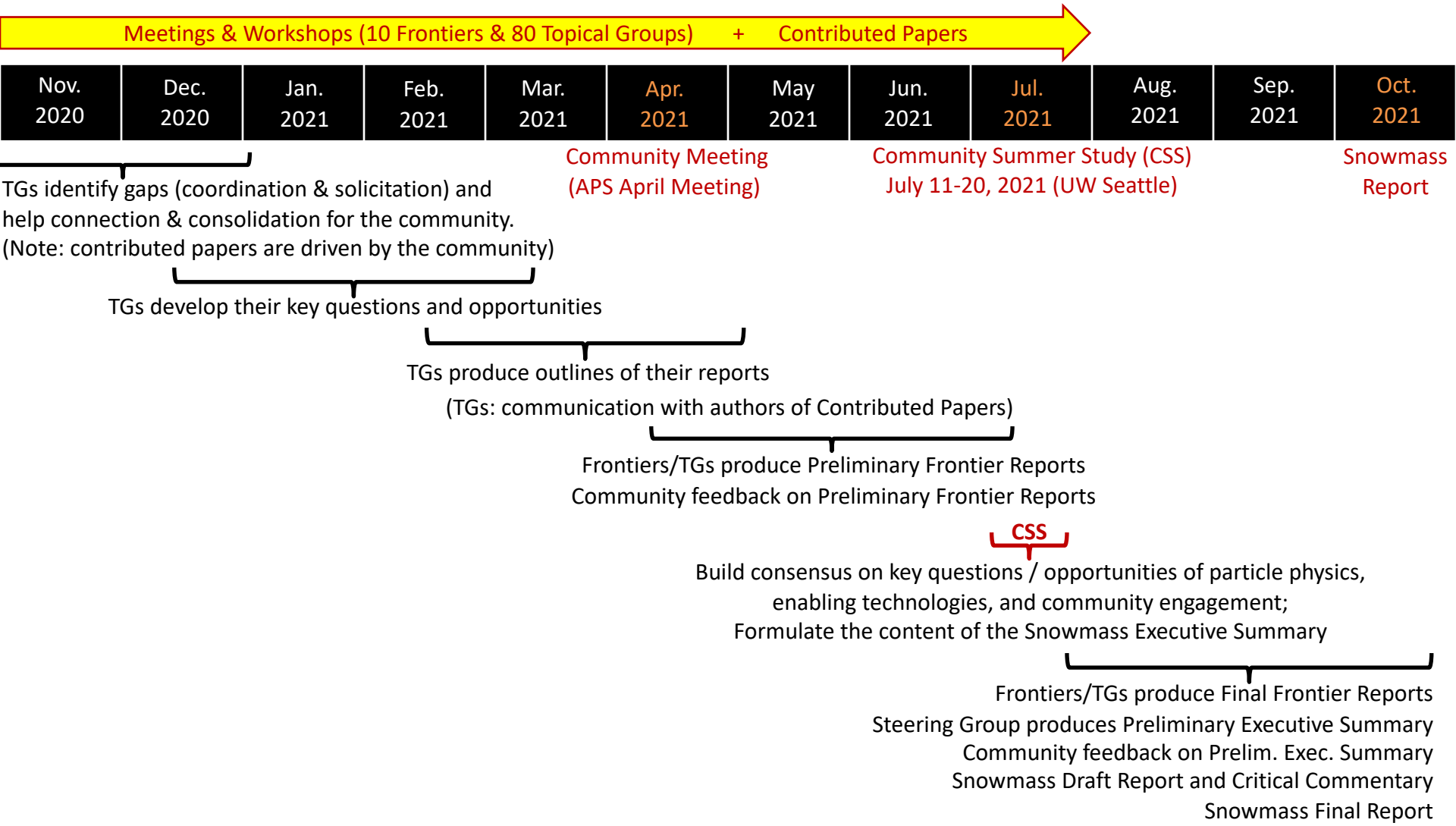
Snowmass 2021 Report Structure (Preliminary)

- **Snowmass Summary for Public**
  - 2 pages
- **Snowmass Summary Report**
  - ~50 pages
    - Executive Summary: ~10 pages
    - Introduction
    - 10 Frontier Executive Summaries
    - Executive Summaries of Multi-Frontier Topics
    - Conclusion
- **Snowmass Book**
  - ~500 pages
    - Snowmass Summary Report (~50 pages)
    - Frontier Summaries (~400 pages with 10 Frontiers)
    - Multi-Frontier Topic Summaries (~50 pages)
- **Topical Group Reports**
  - Topical Group Reports: short reports

  (Written by TG members including early careers)
- **Reports of Multi-Frontier Topics**
  - Multi-Frontier Topics spanning multiple Frontiers.
  - Each Multi-Frontier Topic Summary: ~10 page
- **Contributed Papers**
  - References

  (Written by the community including early careers)

Next Steps: Snowmass Timeline & Process (Preliminary)



Snowmass Workshops in 2021

[Google spreadsheet (continue to be updated with more information)]

Snowmass Workshops in 2021

	March 2021	April 2021	May 2021	June 2021	July 2021	August 2021
Community-Wide		Apr 17-20 (APS)			July 11-20 (UW Seattle)	
Energy Frontier			May 10-14	June 14-18		
Neutrino Frontier	Mar 15-17 (ORNL)					
Rare & Precision Frontier				~early June (U.Cincinnati)		
Cosmic Frontier						
Theory Frontier	Mar 17-19 (UCSB)					
Accelerator Frontier						
Instrumentation Frontier	Mar 18-19, 22					
Computational Frontier						
Underground Frontier						
Comm Engagement Frontier				Dates TBD (BNL)		

HEP Conferences in 2021

La Thuille 2021	March 8-14					
Moriond 2021 (EW)	March 20-27					
Moriond 2021 (QCD)	March 27-April 3					
Quarkonium 2021	March 22-26					
APS April Meeting 2021		April 17-20				
Pheno 2021			May 10-12			
CHEP 2021 (Computing)			May 17-21			
CALOR 2021 (Detector)			May 17-21			
RADCOR 2021			May 17-21			
CIPANP 2021				June 1-6		
LHCP 2021				June 7-12		
FPCP 2021				June 7-11		
CHARM 2021				May 31 - June 4		
EPS 2021					July 26-30	
Lattice 2021					July 26-31	
Higgs 2021					End July	
Lepton Photon 2021						Aug. 9-14

Snowmass Community Summer Study (CSS)

Local Organizing Committee:

Co-chairs

Shih-Chieh Hsu
Gordon Watts
(UW Seattle)

- Alvaro Chavarria (UW Seattle)
- Jason Detwiler (UW Seattle)
- Anna Goussiou (UW Seattle)
- Alejandro Garcia (UW Seattle)
- Seyda Ipek (UC Irvine)
- Laura Jeanty (U. Oregon)
- Joey Key (UW Seattle)
- Tongyan Lin (US San Diego)
- Henry Lubatti (UW Seattle)
- Elise Novitski (UW Seattle)
- Gray Rybka (UW Seattle)
- Jan Strube (PNNL)
- Lauren Tompkins (Stanford U.)
- Tien-tian Yu (U. Oregon)

Program Committee:

- Steering Group
  - Tao Han (Chair), Joel Butler, Sekhar Chivukula, Young-Kee Kim, Priscilla Cushman
  - Glennys Farrar, Gabriela Gonzales, Yury Kolomensky, Sergei Nagaitsev
- Frontier Representatives
  - Ketevi Assamagan,, Phil Barbeu, Nathaniel Craig, Ben Nachman, Meenakshi Narain, John Orrell, Alexey Petrov, Vladimir Shiltsev, Tim Tait, Elizabeth Worcester
- Early Careers
  - Garvita Agarwal, Jacob Zettlemoyer
- Co-chairs of CSS Local Organizing Committee
  - Shih-Chieh Hsu, Gordon Watts

Snowmass CSS 2021 and DPF 2021 (UW Seattle)

- DPF 2021: 5 days → 3 days
  - Preliminary: **July 6-8** (Tuesday – Thursday)
    - Primarily early career presentations
  - In-person (hybrid) or Virtual
    - Decision in Feb. 2021, based on vaccine news

APS DIVISION OF PARTICLES & FIELDS

DPF 2021

MEETING OF THE AMERICAN PHYSICAL SOCIETY DIVISION OF PARTICLES AND FIELDS

- AnnFest
  - Preliminary: **July 9-11** (Friday – Sunday)

Ann Nelson
(Apr. 29, 1958 – Aug. 4, 2019)

- Snowmass CSS 2021
  - **July 11-20** (Sunday – Tuesday)
  - In-person (hybrid) or Virtual
    - Decision in Feb. 2021, based on vaccine news
  - Concerns raised by some community members (not-in-person CSS)
    - Explored later dates (e.g., Winter and Spring 2022): these are okay options to meet the P5 schedule (Report by end 2022 / beginning 2023)
    - Concluded that these are not viable (academic quarter system, …)
  - Concerns raised by other community members (already too long)

Under Development

Snowmass 2021: Summary

- It has been difficult times
  - Impact of COVID-19 on HEP Research, well demonstrated by HEPAP Survey, Snowmass D&I Survey, …
  - All of the Snowmass meetings and workshops so far have been virtual.
  - We have challenges to deal with uncertainty in 2021.

- In spite of this, there have been tremendous efforts and major progress by the community.
  - *Huge thanks to the community!!*

- Snowmass is a community-driven process
  - We welcome any comments, suggestions, and concerns from the community
  - We appreciate the community's continued strong participation in the process
  - Please visit the Snowmass wiki page (https://snowmass21.org/)

- We very much look forward to a productive Snowmass study