SnowMass 2021

- **What is Snowmass?**
  A ``community study" that takes place about once a decade, producing a status report aiming to identify and document a scientific vision for the long-term future of particle physics / HEP in the U.S. and its international partners.

- **Who organizes Snowmass?**
  Led by the Division of Particles and Fields (DPF) of the APS, in collaboration with DAP, DPB, DNP, and DGRAV.

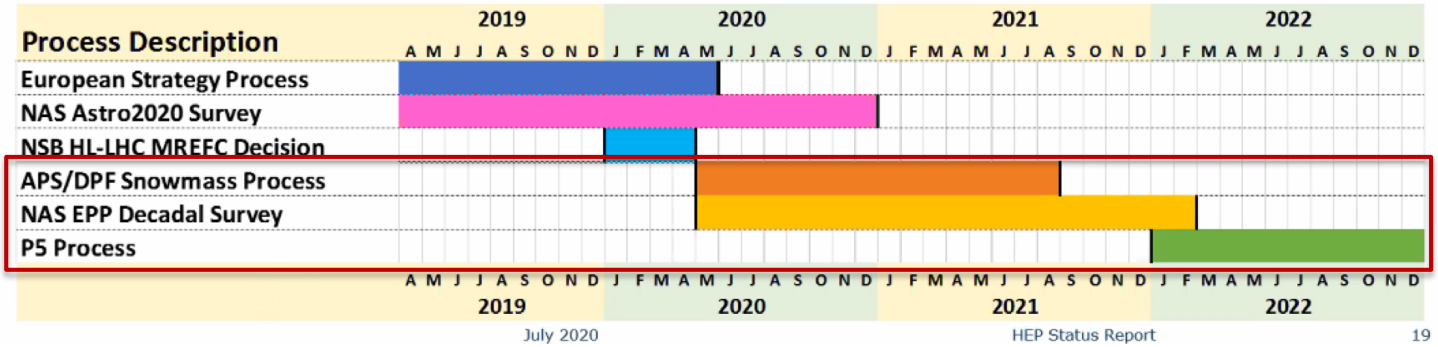
- **Does Snowmass prioritize projects?**
  It DOES NOT prioritize projects - it serves as the input to the P5 panel (Particle Physics Project Prioritization Panel) that is expected to convene in 2022.

Snowmass: Introduction

Jim Siegrist's presentation (2020-07-09)

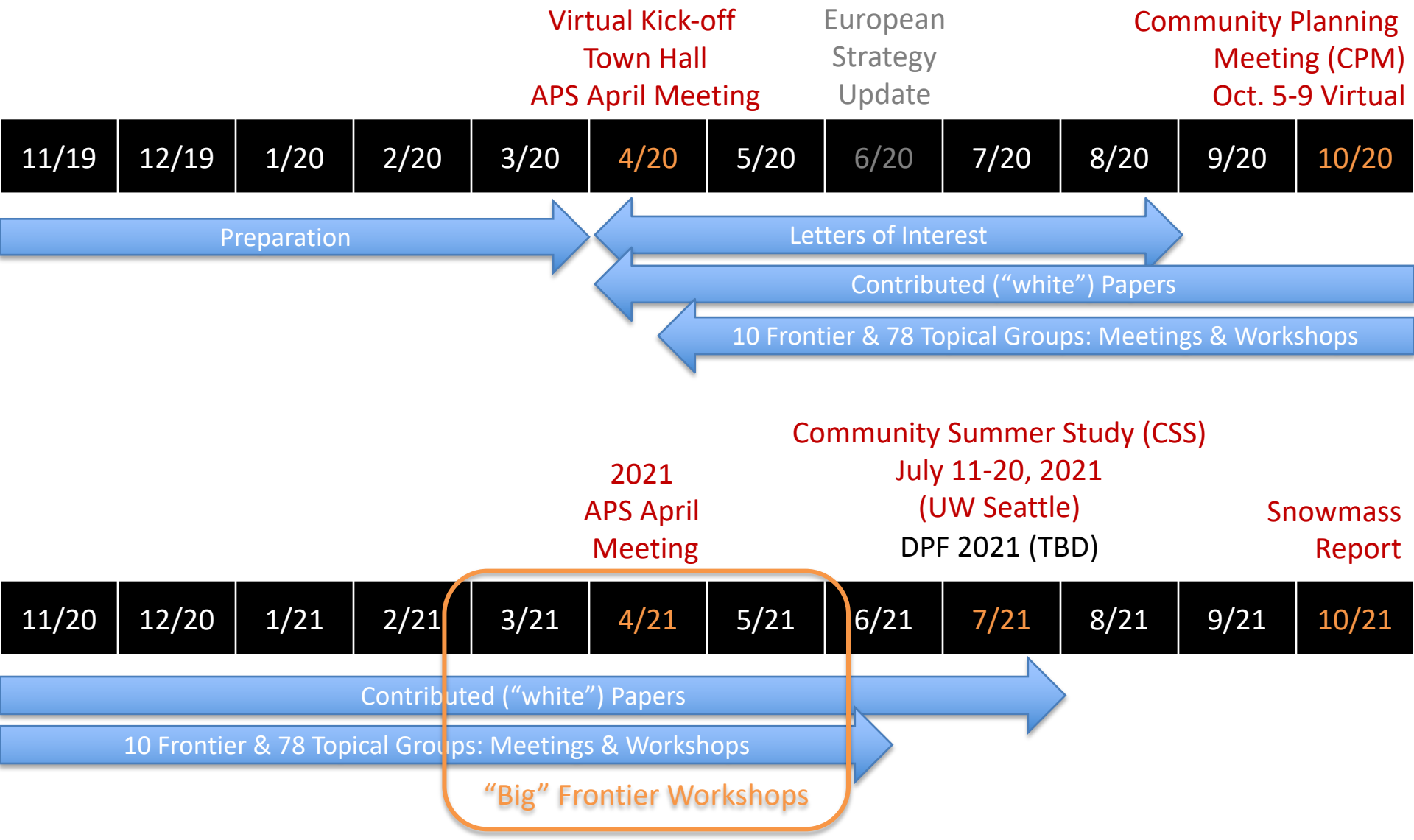
Strategic Planning Timeline

- To provide timely input to the FY25 budget formulation, the next P5 report will be required by March 2023
- U.S. Community Snowmass process is underway with major meeting occurring in summer 2021
- Potential timeline for the next NAS EPP Decadal Survey could be mid-2020 through early-2022
  - Overlap with Snowmass could enable synergy with Snowmass processes and delivery of report as P5 process begins



- Snowmass 2021
- NAS EPP 2022
- P5 2022-2023

Snowmass: Timeline



Snowmass Frontiers

Energy	**Neutrino Physics**
Rare Processes and Precision	**Cosmic**
Theory	**Accelerator**
Instrumentation	**Computational**
Underground Facilities	**Community Engagement**

+ Snowmass Early Career

Theory Frontier

P5 plays an increasingly central role in HEP planning. It is essential that all aspects of theory be represented to P5 via the Snowmass process — both on its own and in relation to projects.

As such, the goal of the Theory Frontier is to articulate the recent advances and future opportunities in all aspects of theory relevant to HEP, including particle theory, formal/foundational theory, cosmological and astro-particle theory, and quantum information science.

The activities of the Theory Frontier will complement theory involvement in the other Snowmass frontiers. As a cross-cutting frontier, the Theory Frontier also facilitates theory-related activities among the other frontiers in topics of overlapping interest.

Theory Frontier: structure

Nathaniel Craig
UCSB

Csaba Csaki
Cornell

Aida El-Khadra
UIUC

Topical Group		Topical Group co-Conveners			
TF01	String theory, quantum gravity, black holes	Daniel Harlow	Shamit Kachru	Juan Maldacena	
TF02	Effective field theory techniques	Patrick Draper	Ira Rothstein		
TF03	CFT and formal QFT	David Poland	Leonardo Rastelli		
TF04	Scattering amplitudes	Zvi Bern	Jaroslav Trnka		
TF05	Lattice gauge theory	Zohreh Davoudi	Taku Izubuchi	Ethan Neil	
TF06	Theory techniques for precision physics	Radja Boughezal	Zoltan Ligeti		
TF07	Collider phenomenology	Fabio Maltoni	Shufang Su	Jesse Thaler	
TF08	BSM model building	Patrick Fox	Hitoshi Murayama		
TF09	Astro-particle physics and cosmology	Dan Green	Joshua Ruderman	Ben Safdi	Jessie Shelton
TF10	Quantum information science	Simon Catterall	Roni Harnik	Veronika Hubeny	
TF11	Theory of Neutrino Physics	André de Gouvêa	Irina Mocioiu	Saori Pastore	Louis Strigari

Theory Frontier: liaisons

Energy Laura Reina (Florida State U)	**Neutrino Physics** Irina Mociouiu (Penn State U) & Kaladi S. Babu (Oklahoma State U)
Rare Processes and Precision Alexey Petrov (Wayne State)	**Cosmic** Flip Tanedo (UC Riverside)
Theory	**Accelerator** Lian-Tao Wang (U Chicago)
Instrumentation	**Computational** Steven Gottlieb (Indiana U)
Underground Facilities	**Community Engagement** Devin Walker (Dartmouth)

Theory Frontier: meetings

- **Community Planning Meeting** (October 5-9 2020, Virtual)
  Snowmass-wide event. Collect initial input needed to achieve Snowmass goals, coordinate between frontiers.

- **Theory Frontier Conference** (March 17-19 2021, KITP)
  Theory Frontier event. Showcase theory developments, consolidate activities in advance of CSS, cultivate interactions between theorists working across frontiers.

- **Community Summer Study** (July 11-20 2021, Seattle)
  Snowmass-wide "main event". Define the most important questions for the field of particle physics & identify ways to address them.

Theory Frontier: documents

- **Letters of Interest (LOI)** (Now - July 31, 2021)
  Informal documents intended to be useful in the first stages of the Snowmass study; could include opinions, interests and proposals that could be further studied. Max 2 pages of text, plus relevant bibliography.

  Note: ***LOI deadline for Project Frontiers*** *(EF, RF, NF, CF,…) is* ***August 31, 2020,*** *to keep in mind for cross-listed LOIs.*

- **Contributed Papers** (Now - July 31, 2021)
  White papers on specific scientific areas, technical articles presenting new results on relevant physics topics, and reasoned expressions of physics priorities, including those related to community involvement.

- **Frontier Summary Documents** (Spring/Summer 2021)
  Summary documents prepared by conveners of each topical group & an overall summary of the theory frontier, drawing from Contributed Papers.

Theory Frontier: channels

- **Wiki:** https://snowmass21.org
  News, calendar, organizational information, links, …

- **Email:** SNOWMASS-THEORY-FRONTIER-GROUP@fnal.gov
  See https://snowmass21.org/theory/start for full list of e-groups, signup information.

- **Slack:** snowmass2021.slack.com
  TF channels include #theory_frontier_topics, #tfXX-[topic_name] channels for each topical group.

Questions

- ***If there is one single (realistic, not totally pie in the sky) outcome you would like to see emerge out of this exercise what would it be?***
  - Xerxes Tata N.C.

- ***Why do we need a TF? For large experimental projects, where community organization is essential, the purpose of Snowmass is clear. But why can't theorists just drive the direction of theory by writing research papers; why do they need to set agendas via white papers? - Lance Dixon*** C.C.

Questions

- ***Hi All, Thanks much for putting the kickoff meeting together -- much looking forward to it! This is not a question, rather a comment regarding my thoughts for the TF. Theory and experiments are the two legs to move our HEP body forward. While they are coupled and correlated, they can be quite independent as well. This is the way I view our TF: we have our frontier topics to pursue, nicely reflected by your topical groups, and we advance our fundamental theory not necessarily related to the current experimental projects, perhaps way ahead of the current experiments. My 2 cents. Thanks! - Tao Han*** A.E.K.

- ***What are the unifying themes of the 11 TF topical groups ? How are we going to organize our activities so that they look like a coherent effort ? - Carlos Wagner*** N.C.

Questions

- ***How will this process handle topics that cut across topical groups? For instance, models of inflation are BSM models (TF08) of cosmology (TF09), are often studied with EFT techniques (TF02) and (especially for large-field inflation) involve considerations of quantum gravity (TF01) as well. Can we reinforce the unity of our field, and the need for strong support across topical boundaries, rather than appearing fragmented and competitive? - Matt Reece*** C.C.

- ***Multiple physics connections exist between the topics of the different Topical Groups. For example, between TF11 and TF05 through TF09. Or between FT08 and most of the other TFs. Is there any plan to try to coordinate between the different TGs? - Alex Friedland*** C.C.

- ***As many theoretical topics are closely related to topics in other frontiers, would any joint activities expected? - Doojin Kim*** A.E.K.

Questions

- ***How to contribute to the sub-groups I'm interested in (I'm interested in more than one topic)? - JiJi Fan*** A.E.K.

- ***I am interested in the discussions in several of the Topical Groups. Will a summary of the discussions in each group be shared afterwards? - Henriette Elvang*** A.E.K.

- ***What are the anticipated avenues for scientists based outside the US to help Snowmass planing? - Marina Marinkovic*** A.E.K

- ***Can I belong to two groups? For example S. T. and CFT - Juan Zarate*** N.C.

- ***Where would "Heavy Quark Spectroscopy" fit in? - Jon Rosner*** C.C.