



Division of Particles & Fields

“Snowmass”: HEP Community Planning Exercise

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**University of Pittsburgh
Chair, Snowmass Steering Group
@ APS DPF Executive Committee**

Snowmass



In June 28 - July 16, 1982, the APS DPF organized an workshop, to “assess the future of elementary particle physics, to explore the limits of our technological capabilities, and to consider the nature of future major facilities for particle physics in the US.”

DPF Chair Charles Baltay:

“In some ways, the 1982 DPF Summer Study represents a new departure in the field of particle physics. In the past, studies were typically held by the large laboratories to address problems specific to that particular laboratory. The 1982 DPF Summer Study was the first attempt in recent years to bring together physicists from the whole country to consider the future of our field from the point of view of the best overall national program. The DPF Executive Committee feels that this summer study was sufficiently useful in this last respect to hold similar summer studies at appropriate times in future years.” **This spearheaded the SSC. The tradition continued.**

Global-scale projects require long-term strategic plans

With year-long, wide community efforts,

Snowmass on the Mississippi
July 29 – August 6, 2013

(~700 participants)



Snowmass 2013 highly successful:

(Report by December 2013)

<https://www.slac.stanford.edu/econf/C1307292/>

The year-long process laid out a roadmap
for great science opportunities,
resulted in broad community buy-in.

essential inputs to P5



“Particle Physics Project Prioritization Panel” (P5)

A subpanel of HEPAP
(HEP Advisory Panel)

Building for Discovery

Strategic Plan for U.S. Particle Physics in the Global Context

Distilled from the Snowmass 2013 inputs, five Science Drivers for the field:

- 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
 - Projects prioritized according to funding scenarios

As a result, highly impactful on the

- Directions/achievements in HEP
- Federal funding profile

for the current and near-future projects in the decade.



The need for Snowmass 2021

Snowmass Goals:

- To define the most important questions for the field of particle physics
- To identify promising opportunities to address them
- **Timing:** 2014 P5 recommendations are being favorably carried out, and it is time to embark the next strategic plan: 2023 – 2025.
 - **Related US domestic programs:**
 - NAS 2020 Decadal survey on Astronomy & Astrophysics
 - NAS Survey for Particle Physics (2021)
 - **Global programs:**
 - 2017 JAHEP; Hyper-K; ILC ...
 - 2020 Update of European Strategy for Particle Physics
 - Latin America: Strategy Forum for Research Infrastructure

Snowmass 2021 organization

Steering Group 2021

APS DPF Chair line

Chair: Tao Han
Chair-elect: Joel Butler
Vice Chair: Sekhar Chivukula
Past Chair: Young-Kee Kim
Ex Officio: Prisca Cushman

DPB: Sergei Nagaitsev
DNP: Yury Kolomensky
DAP: Glennys Farrar
DGRAV: Nicolas Yunes

Advisory Group 2021

- DPF Executive Committee
 - Secretary/Treasurer: Mirjam Cvetič
 - Councilor: Elizabeth Simmons
 - Member-at-Large: Natalia Toro
 - Member-at-Large: Andre de Gouvea
 - Member-at-Large: Mary Bishai
 - Member-at-Large: Lauren Tompkins
 - Member-at-Large: Mayly Sanchez
 - Member-at-Large: Gordon Watts
 - Early Career Member: Julia Gonski
- Editor and Communication
 - 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
 - Europe / Russia
 - Val Gibson, Cavendish Laboratory, UK
 - Berrie Giebels, CNRS, France
 - Latin America
 - Claudio Dib, Universidad Tecnica Federico Santa Maria, Chile

Snowmass 2021 organization

10 Frontiers	80 Topical Groups
Energy Frontier	Higgs Boson properties and couplings, Higgs Boson as a portal to new physics, Heavy flavor and top quark physics, EW Precision Phys. & constraining new phys., Precision QCD, Hadronic structure and forward QCD, Heavy Ions, Model specific explorations, More general explorations, Dark Matter at colliders
Frontiers in Neutrino Physics	Neutrino Oscillations, Sterile Neutrinos, Beyond the SM, Neutrinos from Natural Sources, Neutrino Properties, Neutrino Cross Sections, Nuclear Safeguards and Other Applications, Theoretical Neutrino Physics, Artificial Neutrino Sources, Neutrino Detectors
Frontiers in Rare Processes & Precision Measurements	Weak Decays of b and c, Strange and Light Quarks, Fundamental Symmetries, Lepton Number Violation, Charged Lepton Flavor Violation, Baryon and Lepton Number Violation, Hadron spectroscopy
Cosmic Frontier	Dark Matter: Particle-like, Dark Matter: Composite, Dark Energy & Cosmic Acceleration: The Modern Universe, Cosmic Dawn & Before, Dark Energy & Cosmic Acceleration: Connections
Theory Frontier	String theory, Quantum field theory techniques, CFT and formal QFT, Scattering amplitudes, Effective field theories, Lattice QCD, Collider phenomenology, BSM model building, Quantum information science, Theory of Neutrino Physics
Accelerator Frontier	Accelerators for Education, Accelerators for Neutrinos, Accelerators for Electroweak and Higgs Physics, Accelerators for Physics Beyond Colliders & Rare Processes, Advanced Accelerator Concepts, Accelerator Technology R&D: RF, Magnets, Targets/Sources
Instrumentation Frontier	Quantum Sensors, Photon Detectors, Solid State Detectors & Tracking, Trigger and DAQ, Micro Pattern Gas Detectors, Calorimetry, Electronics/ASICS, Noble Elements, Cross Cutting and System Integration, Radio Detection
Computational Frontier	Experimental Algorithm Parallelization, Theoretical Calculations and Simulation, Machine Learning, Storage and processing resource access (Facility and Infrastructure R&D), End user analysis
Underground Facilities and Infrastructure Frontier	Underground Facilities 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.

Snowmass Early Career

- 1) to represent early career members and promote their engagement in the Snowmass 2021 process;
- 2) to build a long-term HEP early career community that persists after the Snowmass process.

Broad coverage/connection in science and global community !

Snowmass 2021 activities

- Communication platform: Wiki <https://snowmass21.org/>

SnowMass2021 DPF Community Planning Exercise

Welcome page
Announcements
Snowmass Calendar
Ethics Guidelines
Snowmass Report

Organization

- Snowmass Steering Group
- Snowmass Advisory Group
- Frontier Conveners

Community Contributions

- Letters of Interest
- Contributed (White) papers

Help

- Communication
- Monte Carlo simulations
- How to Edit This Wiki
- GOOGLE search

About

- Contact Information
- Terms of use

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. Snowmass will define the most important questions for the field of particle physics and identify promising opportunities to address them. (Learn more about the history and spirit of Snowmass here ["How to Snowmass" written by Chris Quigg](#)). 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.

Join Slack workspace and Snowmass email list!

For joining the snowmass email list: 1) Send an e-mail message to `listservATfnalDOTgov`, 2) Leave the subject line blank, and 3) Type “SUBSCRIBE SNOWMASS FIRSTNAME LASTNAME” (without the quotation marks) in the body of your message. For example, I would send an email like:

To: `listservATfnal.gov`

From: `rhbobATfnal.gov`

Subject:

—whatever delineates the body field—

SUBSCRIBE SNOWMASS ROBERT BERNSTEIN

—and (without this line) just send it!

Snowmass 2021 activities

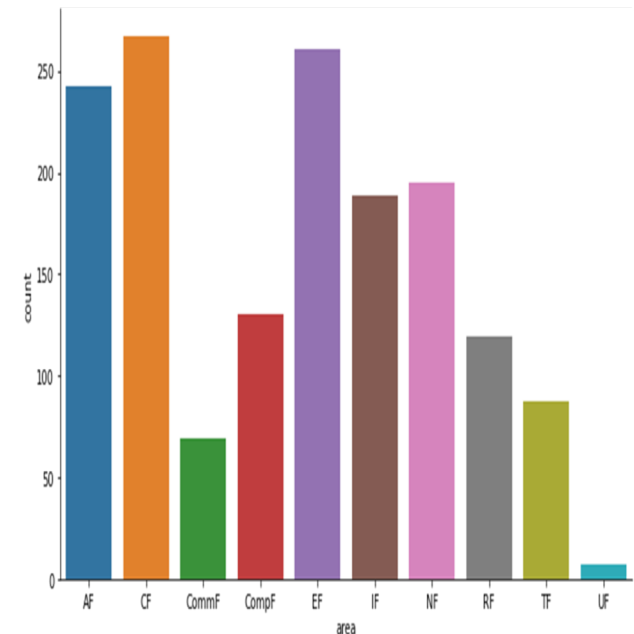
Snowmass kickoff meeting at 2020 APS April Meeting (virtual)

- ~ 600 people participated <https://indico.fnal.gov/event/23601/>
- Frontier conveners (10)
- Community voices (21 speakers)
- DOE/NSF representatives

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
- Include opinions, interests and proposals that could further be studied.

1,574 received in total !
Many LOIs – multiple frontiers



Primary Frontiers

Snowmass 2021 activities

Snowmass Community Planning Meeting

Oct. 5-8, 2020 (FNAL, virtual)

- ~ 3,000 people registered !
- 63 submissions to the “Voices from the Community”
- 25 Plenary speakers; 5 “Future Facilities” panelists
- 101 Breakout sessions

Contributed (“white”) Papers (new deadline: March 15, 2022)

- Specific scientific areas, technical articles presenting new results on relevant physics topics, and reasoned expressions of physics priorities, including those related to community involvement.
- Part of Snowmass proceedings. Remain part of the permanent record of Snowmass 2021, all on arXiv
- Submission instructions: <https://snowmass21.org/submissions/>.

Heading to Community Summer Study (CSS) → Snowmass 2021 in July 10 – 20, 2021, UW-Seattle, but ...

Snowmass New Timeline (January 29, 2021)

Because of the COVID-19 pandemic, the Snowmass Report and the Community Summer Study meeting (CSS) will be delayed by one year until 2022. The overall schedule for the Snowmass process will be adjusted accordingly. After extensive consultation with our community and the frontier conveners/advisors, the Snowmass Steering Group recommends the following general guidelines for the implementation of the Snowmass delay:

- High-level activities will be on hold until the end of June, 2021. These activities include Frontier-level and Topical Group-level workshops, All-conveners meetings, Advisory Group meetings and Newsletters.
- Other Topical Group and cross-frontier activities should be either paused or reduced to a significantly lower level, proceeding only as necessary to ensure scientific continuity, meet essential programmatic needs, or maintain collaborative work with other units and communities.
 - No critical decisions will be made during the hiatus.
 - No individuals should feel obligated to participate in these activities.
- Individual, collaborative and self-organized work can continue at the discretion of the individuals involved.

All paused individual or group activities will continue to receive full consideration once the Snowmass process formally resumes.

Individual frontiers exercise their own practice to accommodate the difficult situations

Updates at Snowmass wiki (<https://snowmass21.org/>)

Where We Are, Chronologically

SEC: Continued, slowdown. A “Heartbeat” mtg in April, more mtgs late June

CEF: Continued, slowdown. Monthly contact meetings on going

EF: EF-06 (MuC), 07 (EIC) continued; TG activities from July 1; EF workshop on Aug.30

AF: AF-1, AF-4, AF-6 continued at a lower pace; TG meetings in August

NF: After a full pause, TG meetings already started; NF workshop on March 16, 2022

RP & PF: Discussions already started; TG mtgs in Sept.; Frontier workshop in May 2022

TF: Full pause (except muon collider activities); TG in August; TF workshop in Spring 2022

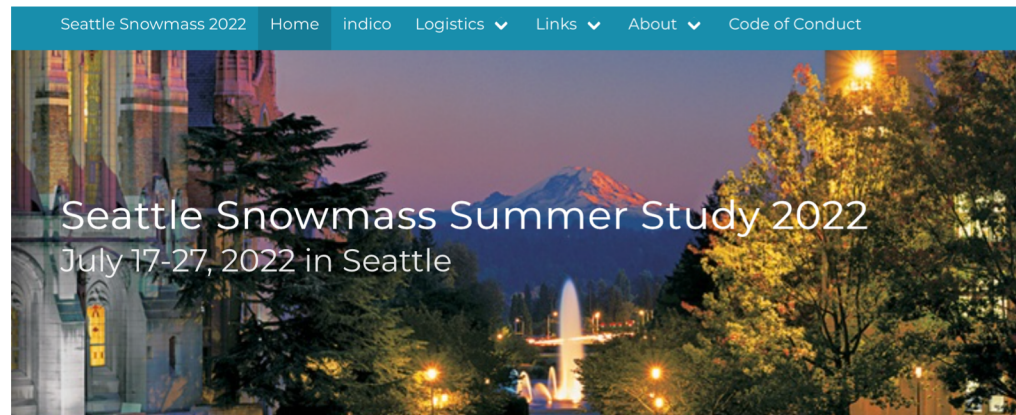
CosmF: Full pause, restart in August (except CF03 just started meetings)

CompF: Full pause, restart activities in late August

IF: Full pause, restart at end of August

UF: Full pause, restart as the others.

- **Upcoming:**
 - All Convener's Meeting **July 26**
 - Advisory Group Meeting **July 30**
- **Full activities early September, 2021**
 - All virtual so far
 - Frontier/Topical Group conveners decide
- **Community Summer Study (CSS, in person)**
July 17 – 27, 2022 @ UW - Seattle

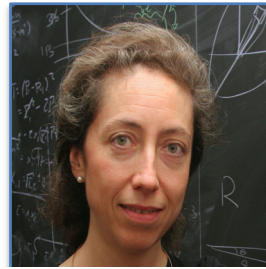


Activity example: Energy Frontier

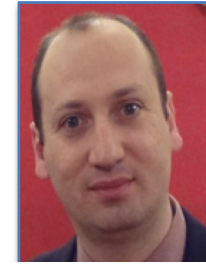
Co-Conveners



Meenakshi Narain
(Brown U)



Laura Reina
(FSU)



Alessandro Tricoli
(BNL)

Topical Group		Topical Group co-Conveners			
EF01	EW Physics	Higgs Boson properties and couplings	Sally Dawson (BNL)	Andrey Korytov (U Florida)	Caterina Vernieri (SLAC)
EF02		Higgs Boson as a portal to new physics	Patrick Meade (Stony Brook)	Isobel Ojalvo (Princeton)	
EF03		Heavy flavor and top quark physics	Reinhard Schwienhorst (MSU)	Doreen Wackerath (Buffalo)	
EF04		EW Precision Phys. & constraining new phys.	Alberto Belloni (Maryland)	Ayres Freitas (Pittsburgh)	Junping Tian (Tokyo)
EF05	QCD and Strong Interactions	Precision QCD	Michael Begel (BNL)	Stefan Hoeche (FNAL)	Michael Schmitt (NW)
EF06		Hadronic structure and forward QCD	Huey-Wen Lin (MSU)	Pavel Nadolsky (SMU)	Christophe Royon (Kansas)
EF07		Heavy Ions	Yen-Jie Lee (MIT)	Swagato Mukherjee (BNL)	
EF08	BSM	Model specific explorations	Jim Hirschauer (FNAL)	Elliott Lipeles (UPenn)	Nausheen Shah (Wayne State)
EF09		More general explorations	Tulika Bose (UW-Madison)	Zhen Liu (Maryland)	Simone Griso (LBL)
EF10		Dark Matter at colliders	Caterina Doglioni (Lund)	LianTao Wang (Chicago)	

Frontier-to-Frontier Liaisons

List of Official Liaisons between the Energy Frontier and other Frontiers:

Other Frontier	Liaisons
Neutrino Physics Frontier	André de Gouvêa (Northwestern)
Rare Processes and Precision	Angelo di Canto (BNL)
Cosmic Frontier	Caterina Doglioni (Lund)
Theory Frontier	Laura Reina (FSU)
Accelerator Frontier	Dmitri Denisov (BNL), Meenakshi Narain (Brown)
Computational Frontier	Daniel Elvira (FNAL)
Instrumentation Frontier	Caterina Vernieri (SLAC), Maksym Titov (CEA Saclay)
Community Engagement Frontier	Daniel Whiteson (UCI), Sergei Gleyzer (Alabama)

Snowmass Energy Frontier Kick-off Workshop

May 21, 2020

US/Eastern timezone

Overview

Timetable

Contribution List

Author List

Speaker List

Registration

Participant List

Participant Photo Dropbox
link

Timetable

< Thu 21/05 >

Print

PDF

Full screen

Detailed view

Filter

Session legend



BSM session



Common



Electroweak session



QCD session



09:00	EF Overview and Organization <i>Virtual</i>	<i>Dr Alessandro Tricoli et al.</i>		09:00 - 09:20
	Discussion <i>Virtual</i>			09:20 - 09:40
	EF01 Higgs Boson properties and couplings (incl. self-coupling) <i>Virtual</i>	<i>Prof. Andrey Korytov et al.</i>		09:40 - 10:00
10:00	Discussion <i>Virtual</i>			10:00 - 10:10
	EF02 Higgs Boson as a portal to new physics <i>Virtual</i>	<i>Isabel Ojalvo et al.</i>		10:10 - 10:30
	Discussion <i>Virtual</i>			10:30 - 10:40
	EF03 Heavy flavor and top quark physics <i>Virtual</i>	<i>Prof. Doreen Wackeroth et al.</i>		10:40 - 11:00
11:00	Discussion <i>Virtual</i>			11:00 - 11:10

EF01: EW Physics: Higgs Boson properties and couplings

Conveners	✉ Sally Dawson, Andrey Korytov, Caterina Vernieri
Mailing-list	✉ SNOWMASS-EF-01-HIGGS_PROPERTIES@FNAL.GOV (🌐 instructions)
Slack channel	🌐 ef01-higgs_properties (🌐 instructions)
Next Event	Wed Aug 18, 12-2 EDT 🌐 https://indico.fnal.gov/event/49921/ , Wed Sep 15, 12-2 EDT 🌐 https://indico.fnal.gov/event/49922/

EF01 studies Higgs properties, including mass, width, and couplings, at proposed future colliders including pp, e+e-, and ep machines. Double Higgs production and subsequent limits on the Higgs self-coupling are included in the EF01 activities, along with the combination of measurements of single and double Higgs production.

EDIT

Group Topics

- Higgs mass and width
- Higgs decays (includes H to invisible and rare decays)
- Higgs production modes: inclusive and differential measurements (includes ttH)
- HH production (includes resonant production)
- Higgs self-coupling
- Anomalous couplings (including CP violation)
- Inputs to the Global Fit





EF01 kick-off meeting

📅 Wednesday May 13, 2020, 12:00 PM → 2:00 PM US/Eastern

Description Zoom meeting: <https://stanford.zoom.us/j/3200397722>

Or iPhone one-tap (US Toll): +18333021536 or +16507249799

Meeting ID: 320 039 7722

-
- | | | | |
|---|------------|--|-------|
| 12:00 PM | → 12:20 PM | Introduction | 🕒 20m |
| Speakers: Prof. Andrey Korytov (University of Florida) , Caterina Vernieri (SLAC) , Sally Dawson (BNL) | | | |
|  5_13_2020.pdf | | | |
| 12:20 PM | → 12:40 PM | Lessons learned from ESG | 🕒 20m |
| Speakers: Christophe Grojean (CERN) , Fabio Maltoni (Universite' catholique de Louvain) , Jorge de Blas (INFN) | | | |
|  Grojean_ESU-2-Sno... | | | |
| 12:40 PM | → 1:00 PM | HH at e+e- | 🕒 20m |
| Speaker: Michael Peskin (SLAC) | | | |
|  eeHiggsIntro.pdf | | | |
| 1:00 PM | → 1:05 PM | FCC-hh studies at Snowmass 2021 | 🕒 5m |
| Speaker: Michelangelo Mangano (CERN) | | | |
|  FCC_hh_snowmas... | | | |

Most importantly:

Contributed (white) Papers (submission deadline March 15, 2022)

- Contributed papers will be part of the Snowmass proceedings.
- They may include white papers on specific scientific areas, articles presenting new results on relevant physics topics, and reasoned expressions of physics priorities, including those related to community involvement.
- These papers and discussions throughout the Snowmass process will help shape the long-term strategy of particle physics in the U.S. Contributed papers will remain part of the permanent record of 2021.
- Instructions for submitting contributed papers are available at <https://snowmass21.org/submissions/>.

Instructions for submitting to the Snowmass Proceedings

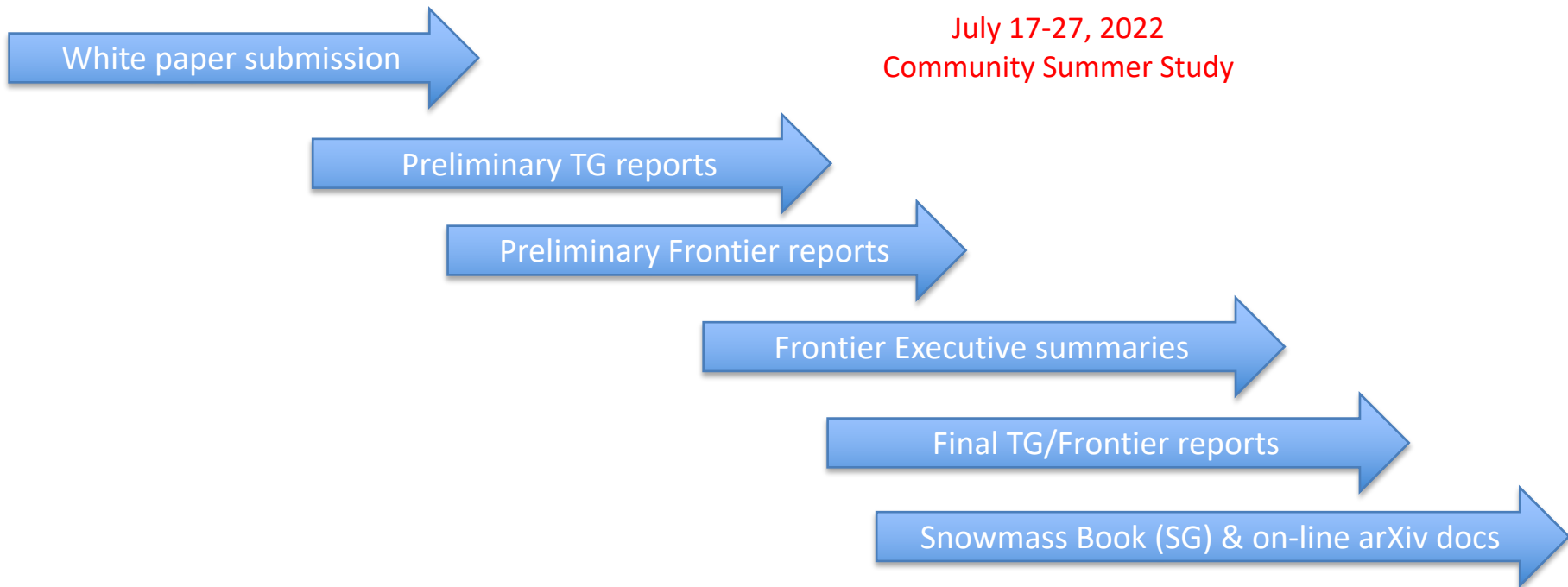
To submit a paper to the proceedings:

1. Post it on the arXiv in the appropriate subject class. Write in the Comments box of the arXiv submission: "contribution to Snowmass 2022".
2. Fill out the form at:

 Submission form

This will notify the proceedings editor Michael Peskin with a simple and perfectly adequate submission email, and it will also add your submission to a database that we can use to check the completeness of the final volume.

New Snowmass Timelines



Welcome your contributions!