



Division of Particles & Fields



Snowmass Update

Tao Han

Snowmass Steering Group / University of Pittsburgh

High Energy Physics Advisory Panel Meeting

Nov. 2, 2021



Snowmass 2021 organization

Steering Group 2021

Chair: Tao Han

Chair-elect: Joel Butler

Vice Chair: Sekhar Chivukula

Past Chair: Young-Kee Kim

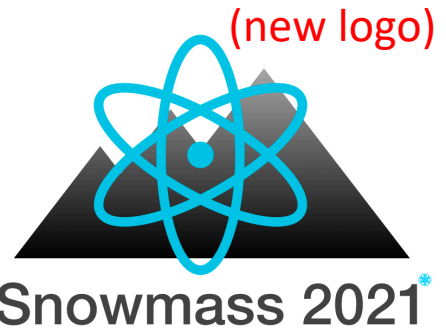
Ex Officio: Prisca Cushman + new vice chair & newly elected members

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
 - Technical liaison – Sergei Chekanov
- 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,
 - Michelangelo Mangano, CERN
 - Latin America
 - Claudio Dib, Universidad Tecnica Federico Santa Maria, Chile

Accelerator Frontier

Co-Conveners



Steve Gourlay
(LBNL)



Tor Raubenheimer
(SLAC)



Vladimir Shiltsev
(FNAL)

Topical Group		Topical Group co-Conveners		
AF01	Beam Phys & Accel. Education	Z. Huang (Stanford)	M. Bei (GSI)	S. Lund (MSU)
AF02	Accelerators for Neutrinos	J. Galambos (ORNL)	B. Zwaska (FNAL)	G. Arduini (CERN)
AF03	Accelerators for EW/Higgs	M. Ross (SLAC)	Q. Qin (IHEP, Beijing)	Georg Hoffstaetter (Cornell)
AF04	Multi-TeV Colliders	Jingyu Tang (IHEP) M. Palmer (BNL)	A. Valishev (FNAL)	N. Pastrone (INFN, Torino)
AF05	Accelerators for PBC and Rare Processes	E. Prebys (UC Davis)	M. Lamont (CERN)	Richard Milner (MIT)
AF06	Advanced Accelerator Concepts	C. Geddes (LBNL)	M. Hogan (SLAC)	P. Musumeci (UCLA)
AF07	Accelerator Technology R&D			
	Sub-group RF	E. Nanny (SLAC)	S. Posen (FNAL)	H. Weise (DESY)
	Sub-Group Magnets	G. Sabbi (LBNL)	S. Zlobin (FNAL)	S. Izquierdo Bermudez (CERN)
	Sub-Group Targets/Sources	C. Barbier (ORNL)	Y. Sun (ANL)	F. Pellemoine (FNAL)

Implementation Task Force (ITF) established

Community Engagement Frontier

Co-Conveners



Kétévi Assamagan
(BNL)



Breese Quinn
(Mississippi)

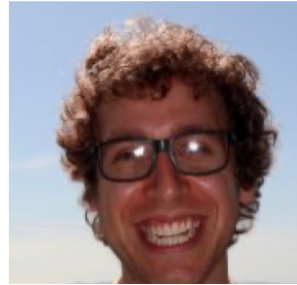
Topical Group		Topical Group co-Conveners			
Comm01	Applications & Industry	Farah Fahim (FNAL)	Alex Murohk (RadiaBeam)	Koji Yoshimura (Okayama)	
Comm02	Career Pipeline & Development	Sudhir Malik (UPRM)	Julia Hogan (Bethel Univ.)	Aneliya Karadzhiniva-Ferrer (Ruđer Bošković Institute)	
Comm03	Diversity & Inclusion	Mu-Chun Chen (UCI)	Johan Bonilla (UC-Davis)	Carla Bonifazi (UFRJ)	Cindy Lin (SNOLAB)
Comm04	Physics Education	Randy Ruchti (Notre Dame)	Sudhir Malik (UPRM)	Sijbrand de Jong (Radboud)	
Comm05	Public Education & Outreach	Sarah Demers (Yale)	Kathryn Jepsen (SLAC)	Don Lincoln (FNAL/Notre Dame)	A. Muronga (Nelson Mandela)
Comm06	Public Policy and Government Engagement	Rob Fine (Rochester)	Louise Suter (FNAL)	Brajesh Choudhary (Delhi)	
<u>Comm07</u>	<u>Environmental and Social Impacts</u>	Ken Bloom (Nebraska)	Véronique Boisvert (Royal Holloway)	Mike Headley (SDATA/SURF)	

Computational Frontier

Co-Conveners



Steven Gottlieb
(Indiana U.)



Ben Nachman
(LBNL)



Daniel Elvira
(FNAL)

Topical Group		Topical Group co-Conveners		
CompF01	Experimental Algorithm Parallelization	Guiseppe Cerati (FNAL)	Katrin Heitmann (ANL)	Walter Hopkins (ANL)
CompF02	Theoretical Calculations and Simulation	Peter Boyle (BNL)	Daniel Elvira (FNAL)	Ji Qiang (LBNL)
CompF03	Machine Learning	Phiala Shanahan (MIT)	Kazu Terao (SLAC)	Daniel Whiteson (Irvine)
CompF04	Storage and processing resource access (Facility and Infrastructure R&D)	Wahid Bhimji (NERSC)	<u>Meifeng Lin (BNL)</u>	Frank Würthwein (UCSD)
CompF05	End user analysis	Gavin Davies (U.Mississippi)	Peter Onyisi (U Texas at Austin)	Amy Roberts (UC Denver)
CompF06	Quantum computing	Travis Humble (ORNL)	Gabriel Perdue (FNAL)	Martin Savage (U Washington)
CompF07	Reinterpretation and long-term preservation of data and code	Kyle Cramner (NYU)	<u>Sabine Kraml (Indiana)</u>	Matias Carrasco Kind (Illinois/ NCSA)

Cosmic Frontier

Co-Conveners



Aaron Chou
(Fermilab)



Marcelle Soares-Santos
(U.Michigan)



Tim Tait
(UC Irvine)

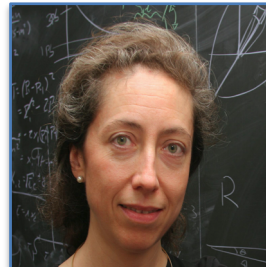
Topical Group		Topical Group co-Conveners			
CF01	Particle DM	Jodi Cooley (SMU)	Tongyan Lin (UCSD)	Hugh Lippincott (UCSB)	Tracy Slatyer (MIT)
CF02	Wavelike DM	Joerg Jaeckel (Heidelberg)	Gray Rybka (UW)	Lindley Winslow (MIT)	
CF03	DM Astro Probes	Alex Drlica-Wagner (FNAL)	Chanda Prescod-Weinstein (NH)	Haibo Yu (Riverside)	
CF04	DE & CA The Modern Universe	Jeff Newman (Pittsburgh)	<u>Jim Annis (FNAL)</u>	Anze Slosar (BNL)	
CF05	DE & CA Cosmic Dawn & Before	Clarence Chang (ANL)	Deirdre Shoemaker (Georgia Tech.)	<u>Laura Newburgh (Yale)</u>	
CF06	Dark Energy complementarity	David Schlegel (LBNL)	Brenna Flaugher (FNAL)	<u>Vivian Miranda (Stony Brook)</u>	
CF07	Cosmic Probes	Luis Anchordoqui (CUNY)	B.S. Sathyaprakash (Penn State)	<u>Rana Adhikari (CalTech)</u>	<u>Ke Fang (Wisconsin)</u> <u>Kirsten Tollefson (MSU)</u>

Energy Frontier

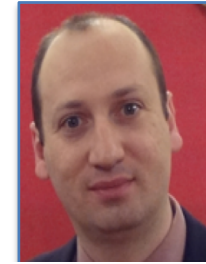
Co-Conveners



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)	<u>Antonio Boveia (Ohio State)</u>

Instrumentation Frontier

Co-Conveners



Phil Barbeau
(Duke)



Petra Merkel
(FNAL)



Jinlong Zhang
(ANL)

Topical Group		Topical Group co-Conveners		
IF01	Quantum Sensors	Thomas Cecil (ANL), Kent Irwin (SLAC), Reina Maruyama (Yale), Matt Pyle (Berkeley)		
IF02	Photon Detectors	Juan Estrada (FNAL)	Mayly Sanchez (ISU)	Abigail Vieregge (Chicago)
IF03	Solid State Detectors&Tracking	Tony Affolder (UCSC)	Artur Apresyan (FNAL)	Lucie Linssen (CERN)
IF04	Trigger and DAQ	Darin Acosta (Florida)	Wes Ketchum (FNAL)	Stephanie Majewski (Oregon)
IF05	Micro Pattern Gas Detectors	Thomas Schwarz (Michigan)	Maxim Titov (SACLAY)	Sven Vahsen (Hawaii)
IF06	Calorimetry	Andy White (UTA)	Minfang Yeh (BNL)	Rachel Yohay (FSU)
IF07	Electronics/ASICS	Gabriella Carini (BNL)	Mitch Newcomer (UPenn)	John Parsons (Columbia)
IF08	Noble Elements	Eric Dahl (Northwestern)	Roxanne Guenette (Harvard)	Jen Raaf (FNAL)
IF09	Cross Cutting and System Integration	Jim Fast (PNNL)	Maurice Garcia-Sciveres (LBL)	Ian Shipsey (Oxford)
IF10	Radio Detection	<u>Amy Connolly (Ohio State) Albrecht Karle (Wisconsin)</u>		

Neutrino Physics Frontier

- Co-Conveners



Patrick Huber
Virginia Tech



Kate Scholberg
Duke University



Elizabeth Worcester
BNL

- Topics relevant to the physics of neutrinos
- Topical Groups and Co-Conveners: note many overlaps in the topics

Topical Group		Topical Group co-Conveners			
NF01	Neutrino Oscillations	Peter Denton	Megan Friend	Mark Messier	Hiro Tanaka
NF02	Sterile Neutrinos	Georgia Karagiorgi	Bryce Littlejohn	Pedro Machado	Alex Sousa
NF03	Beyond the SM	Pilar Coloma	Lisa Koerner	Ian Shoemaker	Jae Yu
NF04	vs from Natural Sources	Yusuke Koshio	Gabriel Orebi Gann	Erin O'Sullivan	Irene Tamborra
NF05	Neutrino Properties	Carlo Giunti	Ben Jones	Lisa Kaufman	Diana Parno
NF06	Neutrino Cross Sections	Jonathan Asaadi	Baha Balantekin	Kendall Mahn	Jason Newby
NF07	Nuclear Safeguards and Other Applications	Nathaniel Bowden	Jon Link	Wei Wang	
NF08	Theory of Neutrino Physics	André de Gouvêa	Irina Mocioiu	Saori Pastore	Louis Strigari
NF09	Artificial Neutrino Sources	Laura Fields	Alysia Marino	Pedro Ochoa	Josh Spitz
NF10	Neutrino Detectors	Josh Klein	Ana Machado	Dave Schmitz	Raimund Strauss

Precision & Rare Processes Frontier

Co-Conveners



Marina Artuso
(Syracuse U.)



Alexey Petrov
(Wayne State U.)



Bob Bernstein
(FNAL)

Topical Group		Topical Group co-Conveners	
RF01	Weak Decays of b and c	Angelo di Canto	Stefan Meinel
RF02	Strange and Light Quarks	Emilie Passemar	Evgueni Goudovski
RF03	Fundamental Physics and Small Experiments	Tom Blum	Peter Winter
RF04	Baryon and Lepton Number Violation	Pavel Filievez Perez	Andrea Pocar
RF05	Charged Lepton Flavor Violation	Sacha Davidson	Bertrand Echenard
RF06	Dark Sector at Low Energies	Stefania Gori	Mike Williams
RF07	Hadron Spectroscopy	Tomasz Skwarnicki	Richard Lebed

Theory Frontier

Co-Conveners



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	<u>Graham Kribs</u>	
TF09	Astro-particle physics and cosmology	Dan Green	Joshua Ruderman	Ben Safdi	Jessie Shelton
TF10	Quantum information science	Simon Catterall	Roni Harnik	Veronika Hubeny	
TF 11	Theory of neutrino physics	André de Gouvêa	Irina Mocioiu	Saori Pastore	Louis Strigari

Underground Facility and Infrastructure Frontier



Laura Baudis (U. Zurich)



Jeter Hall (SNOLAB)



Kevin Lesko (LBNL)



John Orrell (PNNL)

Topical Group		Topical Group co-Conveners and Liaisons			
		Co-conveners			Liaisons
UF01	Underground Facilities for Neutrinos	<u>Accelerator Neutrinos</u> Tim Bolton	<u>Oνββ</u> Patrick Decowski Danielle Speller		<u>Neutrinos</u> Albert de Roeck <u>Astronomical ν</u> Gabriel Orebi Gann
UF02	Underground Facilities for Cosmic Frontier	<u>LXe DM</u> Kaixuan Ni <u>Low Mass</u> Scott Hertel	<u>LAr DM</u> Emilija Pantic		<u>Particle DM</u> Hugh Lippincott Jodi Cooley <u>Instrumentation</u> Eric Dahl
UF03	Underground Detectors	<u>Gravity Waves</u> Laura Cadonati			<u>Instrumentation Frontier</u> Maurice Garcia-Sciveres
UF04	Supporting Capabilities	<u>Radon</u> Richard Schnee	<u>Cleanliness</u> Alvine Kamaha	<u>Low Background Assay</u> Brianna Mount	
UF05	Synergistic Research	<u>Nuclear Astrophysics</u> Daniel Robertson	<u>Geo-microbiology</u> TBD	<u>Geo-engineering</u> TBD	<u>QIS, QC</u> Maurice Garcia-Sciveres
UF06	An Integrated Strategy for Underground Facilities and Infrastructure	Laura Baudis Kevin Lesko	Jeter Hall John Orrell	<u>Early Career</u> Pietro Giampa William Thompson	

Snowmass Early Career

DPF EC Early Career representatives:

plus many active members



Fernanda Psihas, 2019
(Fermilab)



Sara Simon, 2020
(Fermilab)



Julia Gonski, 2021
(Columbia)

+ new EC EC
representative

Key Initiatives

We are organized into five key initiatives:

1. **In-reach:** Professional development and building cohesion within the early career community
2. **Diversity, Equity, and Inclusion (DEI):** Work on initiatives to make the HEP community representative, welcoming, inclusive, and equitable
3. **Survey:** Survey the early career membership
4. **Long-Term Organization:** Define the long-term structure of the early career organization after the Snowmass process
5. **Snowmass Coordination:** Coordinate with the Snowmass frontiers and help get early career members involved in the Snowmass process

Snowmass Community Planning Meeting

5-8 October 2020
Virtual

The primary goal of the Community Planning Meeting is **to develop plans and steps to take (“Snowmass Planning”) between October 2020 and the Snowmass Community meeting in July 2021, leading to a final report in October 2021.**

- ~ 1,570 LOIs contributions
- 63 submissions to the “Voices from the Community”
- 25 Plenary speakers; 5 “Future Facilities” panelists
- 101 Breakout sessions’ organizers, chairs,
and all the participants
- ~ 3,000 participants

While the Snowmass activities were in the full swing,
the COVID-19 pandemic hit hard.

We made a difficult decision to pause/slow-down the process in January 2021. Frontiers implemented the pause/slow-down according to their circumstances.

Looking back, we feel that we made the right decision:

- to battle the pandemic, to preserve our work
- to accommodate the need for balancing personal and professional circumstances.

Snowmass Day

September 24, 2021

US/Central timezone

~ 1,000 registrants

AF	Vladimir Shiltsev	11:00 - 11:10
ComEF	Ketevi-Adikie Assamagan	11:10 - 11:20
CompF	Benjamin Nachman	11:20 - 11:30
CosmF	Aaron Chou	11:30 - 11:40
EF	Alessandro Tricoli	11:40 - 11:50
IF	Petra Merkel	11:50 - 12:00
NF	Patrick Huber	12:00 - 12:10
PDF	Robert Bernstein	12:30 - 12:40

Get all the frontiers and participants back together on the same page and refocus our attention to the Snowmass activities.

Monthly Snowmass Newsletters resumed!
October Newsletter out:

From the Steering Group

Dear Snowmass participants:

Greetings! After the pause/slowdown due to the COVID-19 pandemic since January 2021, the Snowmass Community process has resumed full activities in September 2021.

SEC	Julia Gonski	12:40 - 12:50
Steering Group	Tao Han	

Snowmass activities/communication

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

The screenshot shows the Snowmass 2021 website. The top navigation bar is blue and contains the Snowmass 2021 logo, the text "DPF Community Planning Exercise", a user icon, a document icon, a search input field with the text "Search", and a "SEARCH" button. The left sidebar menu is white and lists various categories: "Announcements" (with "Snowmass Calendar" circled in red), "Ethics Guidelines", "Snowmass Report", "Organization" (with "Snowmass Steering Group", "Snowmass Advisory Group", "Frontier Conveners", "APS DPF Snowmass page", and "Snowmass Early Career"), "Snowmass Frontiers" (with a large red circle around the entire list: "Energy Frontier", "Neutrino Physics Frontier", "Rare Processes and Precision Physics Frontier", "Cosmic Frontier", "Theory Frontier", "Accelerator Frontier", "Instrumentation Frontier", "Computational Frontier", "Underground Facilities", "Community Engagement", and "Snowmass Liaison"), and "Community Contributions" (with "Letters of Interest" and "Contributed (White) papers" circled in red).

Welcome to Snowmass

The Snowmass community planning exercise, that has been delayed since January 2021 due to the COVID-19 pandemic, will resume the full activity from September 2021. For any update, please see the announcement at <https://snowmass21.org/announcements>. The on-going activities and updates from the individual frontiers can be found at their frontier Wiki pages. We encourage you to participate in the activity by signing up to the research frontiers at their Wiki pages, if you haven't already done so.

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.

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. Agendas and presentations of all Snowmass-related meetings are available via [this Snowmass Indico link](#).

Some Activities Update:

- **SG:** continued operation: APS mtg, DPF mtg, other mtgs...
- **Accelerator Frontier:**
 - **Snowmass Muon Collider Forum**
 - **APS 2021 April mtg:** Muon Collider Symposium
 - **Dec. 3, 2020, Apr. 6, 2021:** “Physics Limits of Ultimate beams”
- **Energy Frontier:** Restart workshop **August 30 - Sept. 3**
 - assessed the progress made;
 - shared new studies and ideas;
 - identified gaps in our strategies;
 - updated the community with schedule, goals and plans
- **SEC:** Survey for broad issues associated with Snowmass
- **NF:** Hosting a series of “White paper coordination meetings”
- **UF:** All TG convener’s meeting on **Oct. 15**
- **CEF Mini Online Workshop:** **Oct. 29**
 - in particular, environmental and Societal Impacts

Topical groups/participants are actively engaged!

Upcoming frontier-level meetings

- **Week Feb. 13, Instrumentation Frontier**, Stony Brook
- **Feb. 23 – 25, TF**, KITP-UCSB: hybrid meeting
- **March 16 – 18, NF**, ORNL: virtual meeting
- **March 27, EF**, Brown U
- **May 16 – 19, RPF**, Cincinnati: hybrid meeting
- **May 24 - 26, CEF**, BNL

Preparatory meetings are important:

- Assess where we are: physics and projects
- Identify our decadal goals
- Opportunity/strategy to reach the goals

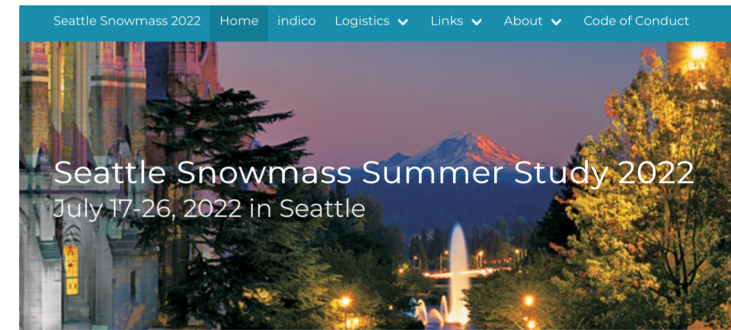
Lecture series:

- Frontier/TG initiated lecture series (upcoming):
Addressing key questions/projects; engage communities
- SEC Core Initiatives:
Colloquium series: “Big Questions in Particle Physics”

- **Contributed papers (white papers) by March 15**
 - They are specific contributions to Snowmass.
 - They include documents on specific scientific areas, technical articles presenting new results on relevant physics topics, and reasoned expressions of physics priorities.
 - They form the basis for the Snowmass write-ups and documents.
(Many thanks to Michael Peskin to serve as the editor)
- **Preliminary Topical Group Reports by May 31**
- **Preliminary Frontier Reports by June 30**
- **Snowmass Book to be delivered to HEPAP by October, 2022**

Community Summer Study (CSS)

July 17 – 26, 2022 @ UW – Seattle



CSS Program Committee:

SG: Tao Han, Joel Butler, Sekhar Chivukula, Young-Kee Kim, Prisca Cushman; Glennys Farrar (DAP), Yury Kolomensky (DNP), Sergei Nagaitsev (DPB), Nicolas Yunes (DGRAV)

Frontiers: Ketevi Assamagan, Phil Barbeau, Nathaniel Craig, Ben Nachman, Meenakshi Narain, John Orrell, Alexey Petrov, Vladimir Shiltsev, Tim Tait, Elizabeth Worcester

SEC: Garvita Agarwal (PhD student), Jacob Zettlemyer (postdoc)

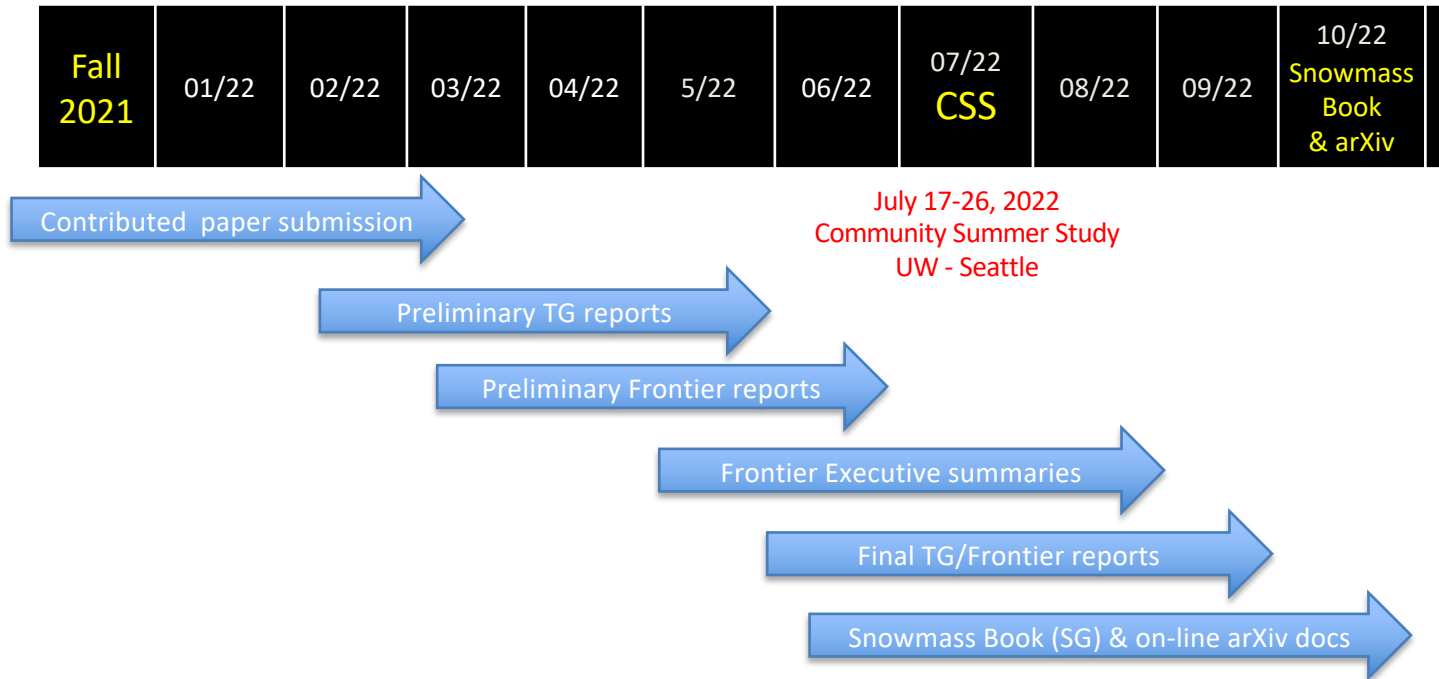
CSS Local Organizing Committee Chairs:

Gordon Watts, Shih-Chieh Hsu

- 10-days, in-person ~700
- First 1.5 days: opening plenary
- Last 1.5 days: concluding plenary
- Mid-days 6.5: breakout sessions
- Will arrange remote access

Logistic details are being discussed by PC

Snowmass Timelines



Snowmass process restarted!
Look forward to the best Snowmass outcome
& the next P5 exercise!