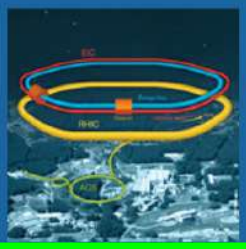
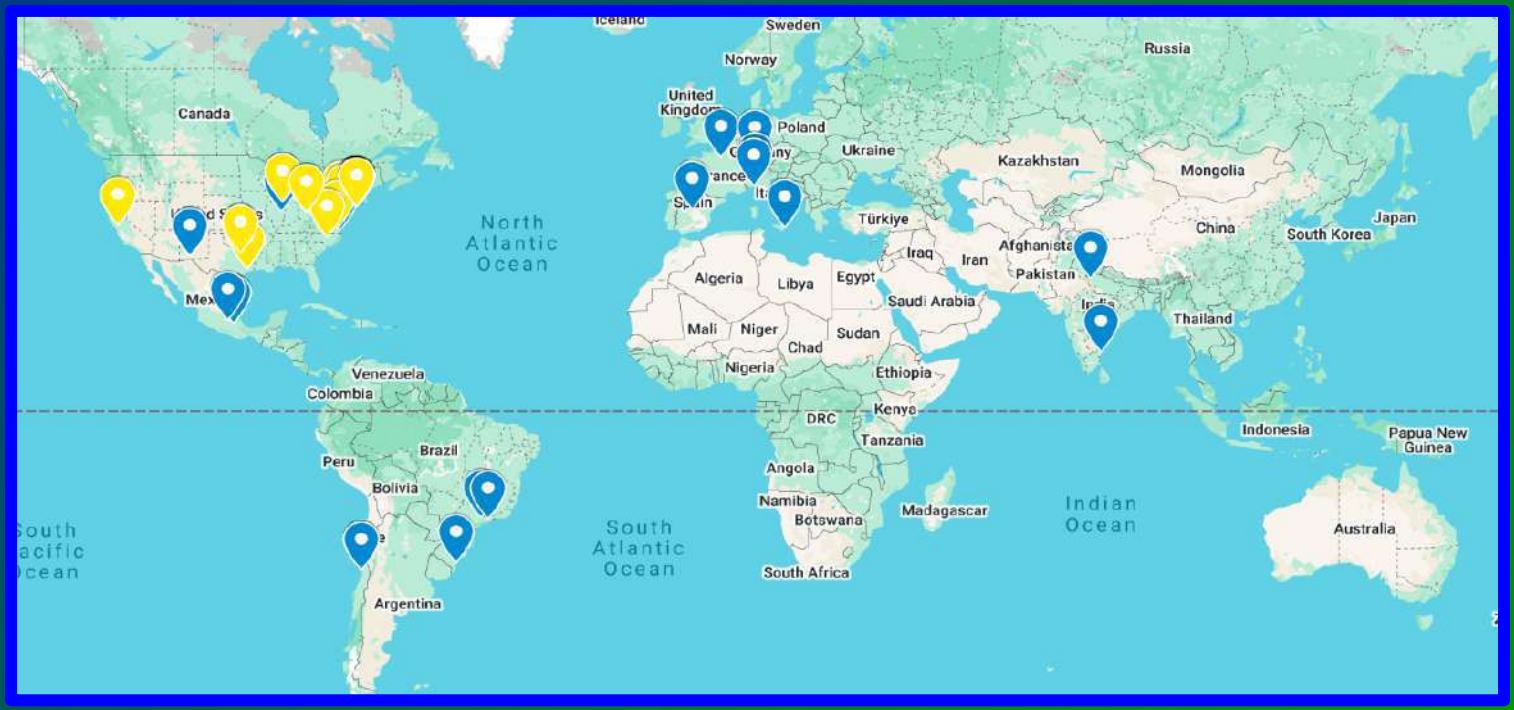


The 2025 CFNS-SURGE Summer Workshop on the Physics of the Electron-Ion Collider



2025 CFNS-SURGE Summer School

on the Physics of the Electron-Ion Collider (EIC)

Stony Brook University hosted the 2025 CFNS-SURGE Summer School on the Physics of the Electron-Ion Collider (EIC) during the period 2-13 June 2025. The school was jointly organized by **Center for Frontiers in Nuclear Science (CFNS)** at Stony Brook University and the **Saturated Glue (SURGE) Collaboration**.

The **CFNS** is dedicated to advancing our understanding of quantum chromodynamics (QCD), with a focus on the role of gluons and sea quarks in the structure of nucleons and nuclei. Its mission is to promote and facilitate the realization of the U.S.-based Electron-Ion Collider (EIC) by strengthening the scientific case and fostering global collaboration among researchers engaged in EIC-related science.

The **SURGE** Collaboration aims to discover and explore the gluon saturation regime in quantum chromodynamics (QCD) by advancing high-precision calculations and developing a comprehensive framework that enables comparison with a wide range of experimental data from hadron and ion colliders, as well as making predictions for the Electron-Ion Collider (EIC).

This school provides the participants with a deeper understanding and improved competency of the fundamental ideas, tools, and techniques that serve as the foundation for investigations of current and future experimental facilities, including the upcoming Electron-Ion Collider (EIC) experiment.

The 2025 CFNS-SURGE School addressed the pressing educational needs of junior physicists involved in forefront research investigations. The format of this program fosters student—lecturer interaction. This experience prepares our students for successful careers both within the physics discipline, and beyond.

Schedule Overview

Week #1	Mon 02	Tue 03	Wed 04	Thu 05	Fri 06
9:00	QCD Intro (Sterman)	QCD Intro (Sterman)	QCD Intro (Sterman)	EIC Intro (Zurek)	EIC Intro (Zurek)
10:30	3D Struct. (Hatta)	3D Struct. (Hatta)	3D Struct. (Hatta)	Detector Tech. (Ullrich)	Surge (Schenke)
13:00	Dimen. Analysis (Olness)	Lattice QCD (Constantinou)	Detector Tech. (Ullrich)	Lattice QCD (Constantinou)	Discussion
14:30	Tutorial #1 (Rahman)	Tutorial #2 (Rahman)	Tutorial #3 (Rahman)	xFitter (xTeam: Olness, Risse)	Student Presentation
19:30	Discussion	Discussion	Free Night @ Port Jeff	Discussion	BBQ 5PM
Week #2	Mon 09	Tue 10	Wed 11	Thu 12	Fri 13
9:00	Collinear PDFs (Hobbs)	Collinear PDFs (Hobbs)	Polarimetry hadron (Eyser)	Jets & Heavy Ion (Mehtar-Tani)	Jets & Heavy Ion (Mehtar-Tani)
10:30	Small x (Kovchegov)	Small x (Kovchegov)	Accelerator Tech. (Montag)	Entanglement (Skokov)	Entanglement (Skokov)
13:00	Calorimetry (Schmookler)	Tracking (Sichtermann)	EIC Perspective (Abhay)	Polarimetry electron (Eyser)	Discussion
14:30	xFitter (xTeam: Olness, Risse)	Tutorial #1 (Sato)	Tutorial #2 (Sato)	Tutorial #3 (Sato)	Student Presentation
19:30	Discussion	Discussion	PJ Dinner 6pm	Discussion	BBQ 5PM

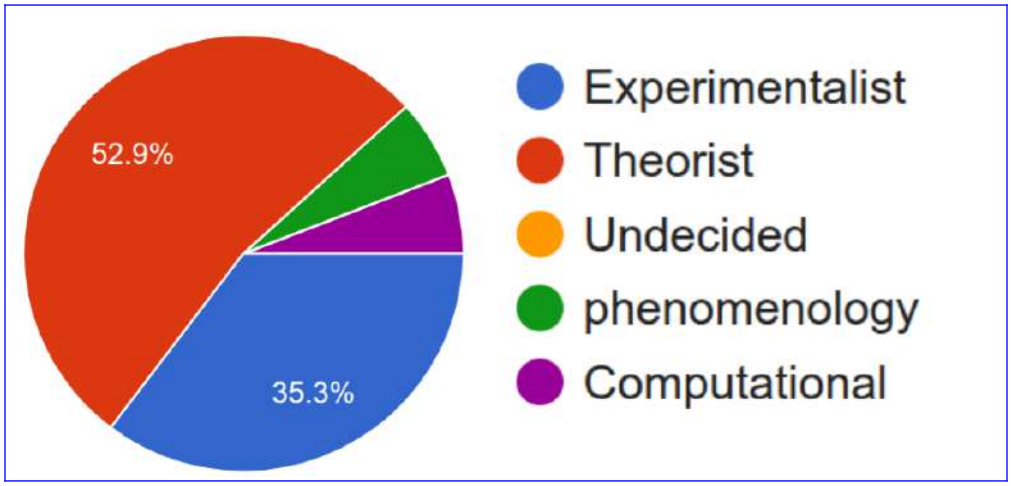
The schools consist of ten days of lectures and discussions where students interact closely with distinguished experts with a broad range of expertise. The audience for these schools is primarily the younger generation of physicists—typically advanced graduate students and postdocs, and the group includes students from both experimental and theoretical disciplines.

Venue:

The school was held at the Center for Frontiers in Nuclear Science (CFNS) at Stony Brook University.

Participants:

This year's school hosted 30 students from 10 countries, including North & South America Europe, and Asia.



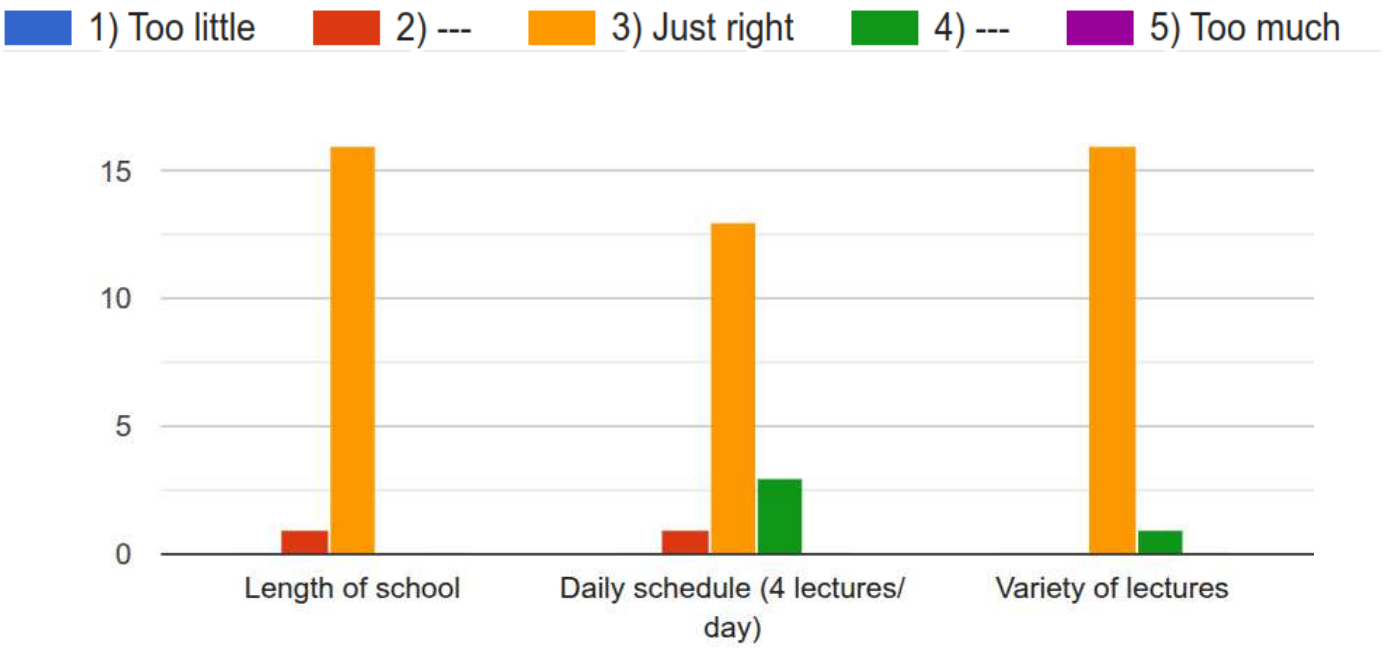
Organizing Committee:

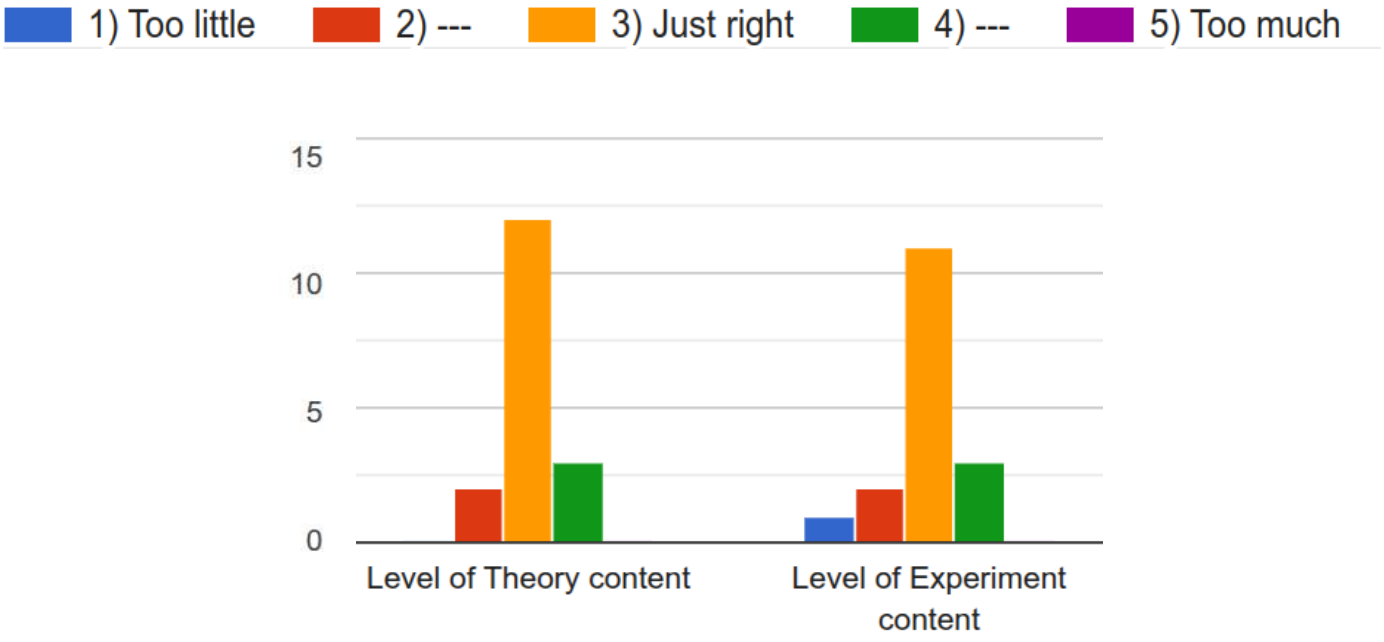
Ross Corliss (CFNS, Stony Brook University)
Socorro Delquaglio (CFNS, Stony Brook University)
Abhay Deshpande (CFNS Director, Stony Brook University & BNL)
Melissa Laguerre (CFNS, Stony Brook)
Wenliang Li (CFNS, Stony Brook)
Fred Olness (SMU, and CTEQ Collaboration)
Alexei Prokudin (Committee Chair, and Penn State University Berks)
Bjoern Schenke (BNL & CFNS)

Lecturers & Topics:

Overview Topics		
Introduction	George Sterman	Stony Brook U
3D Structure	Yoshitaka Hatta	BNL
EIC Physics Intro	Maria Zurek	Argonne
EIC Perspectives	Abhay Deshpande	CFNS & BNL
Experimental Topics		
Calorimetry	Barak Schmookler	U Houston
Polarimetry	Oleg Eyser	BNL
Detector technologies	Thomas Ulrich	BNL
Tracking	Ernst Sichtermann	BNL
Accelerator technologies	Christoh Montag	BNL
Theoretical Topics		
Collinear Structure/PDF	Tim Hobbs	Argonne
Jets & Heavy Ions	Yacine Mehtar-Tani	BNL
Entanglement & Entropy	Vladi Skokov	NCSU
Small x Physics	Yuri Kovchegov	Ohio State
Lattice QCD	Martha Constantinou	Temple U
SURGE Overview	Bjoern Schenke	BNL
Tutorials		
ML/AI Tutorial	Nobuo Sato	JLab
EIC Software	Sakib Rahman	BNL
xFitter Tutorial	Fred Olness & Peter Risse	SMU

Feedback On School Logistics:





Overall impression of the school:

Complete and unedited comments

- The talks were relevant enough to my research, and for sure in the direction I want to follow. I am very much pleased with the school and thank you very much for the opportunity.
- The school was very informative about the future EIC. Some talks relevant to my research include the talks by Sterman, Hatta, Olness, Constantinou, Hobbs, and Kovchegov.
- The school overall was a a real learning opportunity for me. I got to interact with so many experts of the QCD community and with students working in same area of research. Overall, everything was excellent.
- I liked the overall quality of the lectures. Most of them provided an overview of topic far away from my research interest. I felt that some of the lectures were a bit rushed: I would have preferred having more time to pause and discuss the implications of certain results than rushing to something else.
- My overall impression of the school was very positive. The program was well-organized, and the environment was both stimulating and collaborative. Several talks were particularly relevant and useful for my research—they provided valuable insights, introduced new methodologies, and helped me view my work from different perspectives. I especially appreciated the presentations by Ullrich and Sterman, which were extremely engaging and closely aligned with my research interests. It was a great opportunity to connect with experts in the field and fellow researchers.
- it was very useful. My research is not directly related to the small x theory but the school helps me to understand a lot of things from a different perspective
- The school provided a thorough overview of the Physics relevant for the EIC. It opened me up to new avenues of research, and put my own into context. At the end of it all, I feel more comfortable with what I am doing, and immensely inspired.
- It was one of the best school I have attended so far. I got to learn lots of new topics including theory part for EIC. Yes, the talks regarding detector ware helpful for me.

- Well structured with a good introduction of the science regarding the EIC. Some of the talks were relevant for my research even though it is currently focused on hadron-hadron collisions, however, the basic concepts could also apply in my context.
- It was amazing! I really enjoyed the school and most of the talks!
- Most talks were useful, although I would have liked more connection between theory and experiment
- I had the best possible impression of the school. All the lectures were extremely relevant to my academic development as a particle physicist. I’m grateful to all the contributors, organizers, and staff. It was an incredible experience.
- I found the experimental discussions (mostly the detector R&D) the most helpful as it relates to my area of study. The theoretical discussions went over my head, but I imagine once I see it again I'll be far more comfortable with it than if I hadn't had this experience in the summer school.
- The school was good, enough variety of topics and good lecturers, the practical sessions were also okay, even tough we spent too much time with preparations (better to send instructions on how to install/download relevant software in advance)
- The school provided a great overview of the experimental aspect of EIC, covering the possibilities of the processes to be analyzed and how they are measured. The theoretical classes provided a great mathematical description of this new physics that will be discovered.
- I had a lot of fun, learned a ton, and was able to network and connect with my peers. It was a great school!
- I found the school to be of very high quality, both in terms of content and organization. The lectures were well structured and delivered by experts in the field. Overall, I was able to learn something relevant from each lecture, even those outside my immediate research focus. Relevance to My Research: In particular, the introductory lectures on QCD and the sessions on small-x physics were especially relevant to my research.

External Resources:

The full Indico page:

https://indico.cfnssbu.physics.sunysb.edu/event/357/

Links to YouTube lecture recordings:

https://www.youtube.com/playlist?list=PLMWOHGJUmRm4wGP6-yDjIEhZ29c5h-2O2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