

CFNS Workshop on Electron-Nucleus Interactions at the EIC



Welcome

Abhay Deshpande

Center for Frontiers in Nuclear Science (CFNS)

July 6-7, 2023





**Center for Frontiers
in Nuclear Science**

<https://www.stonybrook.edu/cfns/>

Founded in September 2017
Operations started in ~2018

Simons Foundation
+ NY State : Renovations at Stony Brook
+ BNL : Renovations at BNL (Seminar Room)

Vision

A Center at Stony Brook for all scientists interested in the US Electron Ion Collider (& Nuclear Science)

A “home” for

- scientific discourse related to Electron Ion Collider and
- attract & support early career scientists interested in the EIC
- help seed future detector collaborations

Work with the world-wide EIC Users Group & BNL, Jefferson Lab Labs to realize the US Electron Ion Collider.

CFNS Activities (I)

300-500 visitors/year the Center (through COVID: 700-1000 -remote)

- SBU-BNL Joint Seminars : 2/month alternate between BNL and SBU
 - Has now been made formally a graduate course at Stony Brook (PHY 674) → now held at Stony Brook
- CFNS Workshops and Adhoc Meetings
 - 4-6 workshops (50-70 people, 4-7 days) and 3-4 ad-hoc meetings (15-20 people, 2-3 days) **every year**
- CFNS post-doctoral fellow program (theory & experiment)
 - Approximately 10 postdocs at any time between BNL and Stony Brook
 - Joint CFNS-Remote Institute Post Docs , hired between 2019-2020 (~5) now in **third successful cycle**
 - **Most of them have secured tenured or tenure-track positions around the world**

CFNS Activities (II)

300-500 visitors/year the Center (through COVID: 700-1000 -remote)

- Short- & long-term visitor program started in 2019
- CFNS summer school started in 2019: ~180 students from 26 countries graduates of CFNS summer schools so far
 - 1st European CFNS EIC Summer School (Italy, June 2023)
 - Plan to start regional EIC Summer Schools: ASIA, AFRICA, SOUTH AMERICA in addition
- **Edward Bouchet Initiative:** programs to support under-represented minorities (**URMs**):
 - Partially funded by DOE: BNL/CFNS: Initial 2 yrs, just learnt will be extended to +3
 - First cohort of 9 students: 7 in graduate school: 2 joined SBU (2 more in 2023), 5 @ other grad schools
 - Edward Bouchet Post Doctoral Fellow – about to be announced



Governance and day-to-day operation

- **Director:** Abhay Deshpande
- **Scientific Coordinators:** Ross Corliss (SBU) & J.H. Lee (BNL)
- **CFNS Steering Committee** (Help implement IAC's advice & run local activities)
 - A. Deshpande (SBU/BNL, Chair) T. Hemmick (SBU), D. Kharzeev (SBU/BNL), [J. Kiryluk \(SBU\)](#), [L Ruan \(BNL\)](#), T. Ullrich (BNL), R. Venugopalan (BNL, Co-Chair), Ex officio: Ross Corliss (SBU) & J. H. Lee (BNL)
- **Seminar Coordinators:**
 - [Shohini Bhattacharya \(BNL/CFNS\)](#), Wenliang Li (SBU)
- **Administrative Assistants:**
 - [Socorro Delquaglio** \(SBU\)](#), [Rachel Inguenta \(BNL\)](#) [Marlene Vera-Vitteri* \(SBU\)](#)

** About to retire will need a quick turn around for approving a state FTE from the Provost's office

* Retired April 2022 being replaced now in support of the CFNS Theory Activities

CFNS Governance

- **International Advisory Committee (Review Center Operations)**

- A. Caldwell (MPI, Germany), L. Elouadrhiri (Jlab), B. Jacak (UCB/LBNL), X. Ji (UMD/CNF), Y. Kovchegov (OSU), Z.-E. Meziani (ANL), R. Milner (MIT, Chair), B. Mueller (Duke), W. Nazarewicz (MSU), P. Newman (Birmingham, UK), B. Pasquini (INFN/Pavia), F. Pilat (ORNL), J. Qiu (Jlab), G. Sterman (SBU/YITP), W. Vogelsang (Tubingen, Germany)
- Ex. Officio: D. Dean (Jlab, DD), Haiyan Gao (BNL, ALD), Marco Radici (INFN, Pavia)
- Optional rotation of 1/3 committee every three years

- **Program Advisory Committee (Review/recommend Workshops)**

- M. Diehl (DESY), C. Keppel (Jlab, ALD), K. Kumar (U. Mass.) P. Shanahan (MIT), F. Yuan (LBNL)
- Optional rotation of 1/3 committee every three years

Physics with e-A scattering at the EIC

- Nuclei : a defining feature of the EIC physics program. All nuclei
- Significant early focus on heavy nuclei – with low-x physics in the EIC Science case -- but since 2017, light nuclei have shown significant emergence in the scientific discourse for EIC physics.
- CFNS led two workshops dedicated to light nuclei:
 - [Exploring QCD with light nuclei at EIC](#) Jan. 21-24, 2020, Stony Brook, NY
 - [Polarized light ion physics with EIC](#), Feb. 5-9, 2018, Ghent, Belgium

Summary: Exploring QCD with light nuclei at EIC

CFNS Workshop, Stony Brook University, Jan 21-24, 2020 [\[Webpage\]](#)

Organizers: Abhay Deshpande (Stony Brook U. & BNL), Raphael Dupre (CNRS Saclay), Maria Patsyuk (JINR Dubna), Misak Sargsian (Florida International U.), Mark Strikman (Penn State U.), Christian Weiss (JLab)



- Basic information
- Context and objectives
- Outcomes and follow-up
- CFNS venue and support



Workshop: Outcomes and follow-up

6

Observations and conclusions

- Dedicated community, great interest, good interactions
- EIC enables new probes of short-range nuclear structure and interactions: gluons, coherent/diffractive processes
- EIC can not only explore nuclear partonic structure (EMC effect, shadowing) but also resolve open questions in hadronic picture of nuclei (SRCs, nuclear core)
- Forward proton/neutron/ion detection critical for many physics applications (tagging, coherent processes), design/optimization should continue with high priority
- Natural path to EIC for short-range nuclear physics community around JLab/GSI/NICA
- Low-energy nuclear structure in high-energy processes: Theory input needed, synergies with low-energy NP
- Many ideas for light-ion physics studies for EIC Yellow Report and beyond

Some specific outcomes reported by participants

- Publication on pD scattering with linearly polarized deuteron and gluon transversity inspired by exchanges at workshop: S. Kumano and Qin-Tao Song, Phys. Rev. D 101 (2020) 094013
- Publication on short-range correlation and EMC effect studies with D and ^3He emerged from discussions at workshop: E.P. Segarra et al., 2006.10249
- Collaboration to develop event generator for nuclear DVCS generator advanced by workshop (R. Dupre, S. Scopetta et al.); initiative for new physics studies in coherent processes with light nuclei (V. Guzey, S. Scopetta, M. Strikman, et al.)
- Influence on Workshop "Physics program for the first stage of the NICA SPD experiment," Dubna, Russia, Oct 5-6, 2020 (Yu. Uzikov et al.) [\[Webpage\]](#); summary of results from CFNS workshop presented by M. Strikman
- Influence on CFNS Workshop "Target fragmentation physics with EIC," 28-30 2020 (J.-H. Lee, M. Ruspa, A. Stasto, M. Strikman, C. Weiss) [\[Webpage\]](#)

Welcome to CFNS

This is the third in the series of CFNS e-A physics workshops with a focus on light nuclei

Have tangible and clearly defined outcomes, with stepwise progress towards them: Good luck and build a great program for the EIC