

Workshop: Theory for EIC in the next decade

Peter Petreczky



Goal of the workshop: review the needs and challenges for EIC theory and implications of these for the Nuclear Physics Long Range Plan and make recommendation from the EIC theory community to be presented at the upcoming Hot and Cold QCD Town Hall Meeting, at MIT, September 23-25, 2022,

<https://indico.mit.edu/event/538/>

and to provide input for the QCD white paper(s) that will come out from the Town Hall Meeting

Charge to NSAC: Long Range Plan should indicate what resources and funding levels would be required, including construction of new facilities, mid-scale instrumentation, and Major Items of Equipment, to maintain a world leadership position in nuclear physics research. The LRP should also describe the potential impacts and priorities under constant level of effort budgets, 2% growth per year using the FY 2022 enacted funding level as a reference.

Long Range Plan timeline:

- July 13, 2022, DOE/NSF charge
- Pre-town hall meeting workshops:
 1. Computational Nuclear Physics and AI/ML Workshop, SURA, Washington DC, September 6-7, 2022
 2. This workshop
- Town Hall Meetings:
 1. Hot and Cold QCD Town Hall will be at MIT, September 23-25, 2022
 2. The Nuclear Structure, Reactions, and Astrophysics, ANL, November 14-16, 2022
 3. The Fundamental Symmetries, Neutrons and Neutrinos, Chapel Hill, NC, December 13-15, 2022

- May 2023: Resolution committee
- December 2023: publication of the Long Range Plan
- Might have effect on FY24 budget
- Will have effect on FY25 budget formulation

The path forward for EIC theory: can a dedicated EIC Theory Consortium address the needs ? (like FRIB theory Alliance, see the talk by Filomena Nunes after the break)

What ?

Draft recommendation: "We recommend the establishment of a national EIC theory consortium. This consortium will enhance the collaboration between different institution working on EIC theory, and significantly contribute to workforce development, diversity, equity, inclusion in EIC theory, through the national EIC theory fellow program and tenure-track bridge positions at universities and national laboratories across the U.S."

Why ?

Workshop summary: put together a workshop summary suitable to serve as an input to the QCD white paper(s), writing committee consists of Bjoern Schenke, Yacine Mehtar-Tani, Yong Zhao, Martha Constantinou, Zhongbo Kang , Yoshitaka Hatta, Phiala Shanahan, Ivan Vitev, Feng Yuan, Alexei Prokudin (feel free to join)

Computational Nuclear Physics and AI/ML Workshop

- Organized by:
 - Alessandro Lovato (ANL)
 - Joe Carlson (LANL)
 - Phiala Shanahan (MIT)
 - Bronson Messer (ORNL)
 - Witold Nazarewicz (FRIB/MSU)
 - Amber Boehnlein (JLab)
 - Peter Petreczky (BNL)
 - Robert Edwards (JLab)
 - David Dean (JLab)
- 6-7 September 2022 at SURA in Washington, DC
- 60 registered participants (40 in person, 20 on line), in
- <https://indico.jlab.org/event/581/>
 - All talks archived
 - Short white paper being prepared for the LRP



6-7 September, 2022 / SURA headquarters

Organized by:

Alessandro Lovato – Joe Carlson (LANL), Phiala Shanahan (MIT), Bronson Messer (ORNL)
Witold Nazarewicz (FRIB/MSU), Amber Boehnlein (JLab), Peter Petreczky (BNL)
Robert Edwards (JLab), David Dean (JLab)

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Schedule

Registration, schedule, and other information can be found at: <https://indico.jlab.org/event/581/>

Tuesday, 6 September

1:00 – 1:05 Welcome, David Dean and Sean Hearne
1:05 – 1:20 DOE remarks, Tim Hallman
1:20 – 2:00 QCD, William Detmold (JLab) and Swagato Mukherjee (BNL)
2:00 – 2:40 Quantum many-body problems, Thomas Papenbrock (UT/ORNL)
2:40 – 3:00 BREAK
3:00 – 3:40 Fundamental Symmetries, Emanuele Mereghetti (LANL)
3:40 – 4:20 Astrophysics, George Fuller (UCSD)
4:20 – 5:00 AI/ML, Amber Boehnlein (JLab)
5:00 – 5:40 Preliminary list of recommendations discussion (Peter Petreczky, lead)
5:40 – 7:30 Reception

Wednesday, 7 September

7:45 – 8:30 Continental Breakfast
8:30 – 10:00 Breakout Sessions

1. QCD (Phiala Shanahan, lead)
2. Nuclear Structure and fundamental symmetries (Alessandro Lovato, lead)
3. Astrophysics (Bronson Messer, lead)

10:00 – 10:30 Break
10:30 – 12:00 Breakout reports
12:00 – 1:00 Lunch
1:00 – 2:30 Recommendations discussion and next steps

 Jefferson Lab
Thomas Jefferson National Accelerator Facility

 SURA

Workshop Resolution

High-performance computing is essential to advance nuclear physics on the experimental and theory frontiers. Increased investments in computational nuclear physics will facilitate discoveries and capitalize on previous progress. Thus, we recommend a targeted program to ensure the utilization of ever-evolving HPC hardware via software and algorithmic development, which includes taking advantage of novel capabilities offered by AI/ML.

The key elements of this program are to:

- 1) Strengthen and expand programs and partnerships to support immediate needs in HPC and AI/ML, and also to target development of emerging technologies, such as quantum computing, and other opportunities.
- 2) Take full advantage of exciting possibilities offered by new hardware and software and AI/ML within the nuclear physics community through educational and training activities.
- 3) Establish programs to support cutting-edge developments of a multi-disciplinary workforce and cross-disciplinary collaborations in high-performance computing and AI/ML.
- 4) Expand access to computational hardware through dedicated and high-performance computing resources.

Similar computational nuclear physics workshop was organized for the 2015 Long Range Plan and its recommendation have been adopted as one of the initiatives in 2015 !