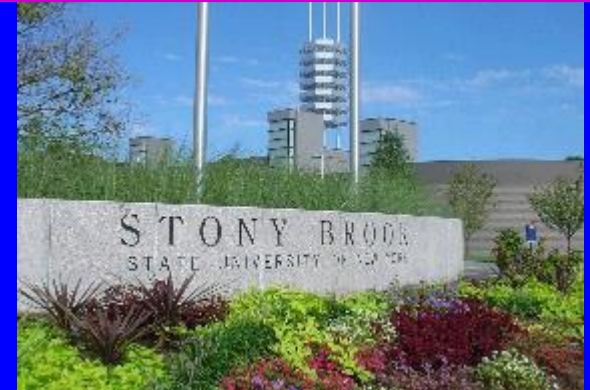


Some thoughts on the 2025 CFNS Exotic Heavy Meson Spectroscopy Workshop



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On behalf of the organizing committee

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CFNS, Stony Brook University, April 14-17, 2025

Good productive workshop !

- We had very nice talks and good detailed discussions on
 - XYZ experiments' statuses and plans; plus Elke's and Abhay's talks
 - XYZ structure and theoretical interpretation
 - Heavy quarkonium production theory
 - Partial-wave analysis
 - Heavy quarkonium and XYZ detection with ePIC

Plans on making the White Paper (motivation)

- In recent years, people from various collaborations or initiatives wrote their white papers or similar documents
- For instance:
 - Hot QCD White Paper
 - The Present and Future of QCD
QCD Town Meeting White Paper – An Input to the 2023 NSAC Long Range Plan
 - Fundamental Symmetries, Neutrons, and Neutrinos (FSNN):
Whitepaper for the 2023 NSAC Long Range Plan
 - CFNS Ad-Hoc meeting on Radiative Corrections Whitepaper
 - Snowmass 2021 whitepaper: Proton structure at the precision frontier
 - The Solenoid Large Intensity Device (SoLID) for JLab 12 GeV
 - The case for an EIC Theory Alliance: Theoretical Challenges of the EIC

Plans on making the White Paper (three examples)

- SoLID white paper summarizes
 - rich physics program to be realized with the SoLID apparatus
 - how the SoLID will be able to overcome challenging requirements for having high-precision measurements on nucleon structure

- Snowmass proton structure white paper summarizes
 - status and future prospects for determination of high-precision PDFs applicable in a wide range of energies and experiments
 - various synergies between experimental and theoretical studies of hadron structure

- EIC Theory Alliance white paper
 - outlines physics opportunities provided by the Electron Ion Collider
 - reviews present status and future challenges in EIC theory that have to be addressed
 - discusses scientific goals and scope of such an EIC Theory Alliance

Our white paper may have the following content (just an example)

- 1) Hadron spectroscopy's place within the EIC entire program
- 2) Making a strong physics case
- 2) Having experimental section (each contribution 3-6 pages long)
- 3) Having theoretical section (each contribution 3-6 pages long)
- 5) Contributors could write about the main points of their presentations, and what connection with EIC there might be

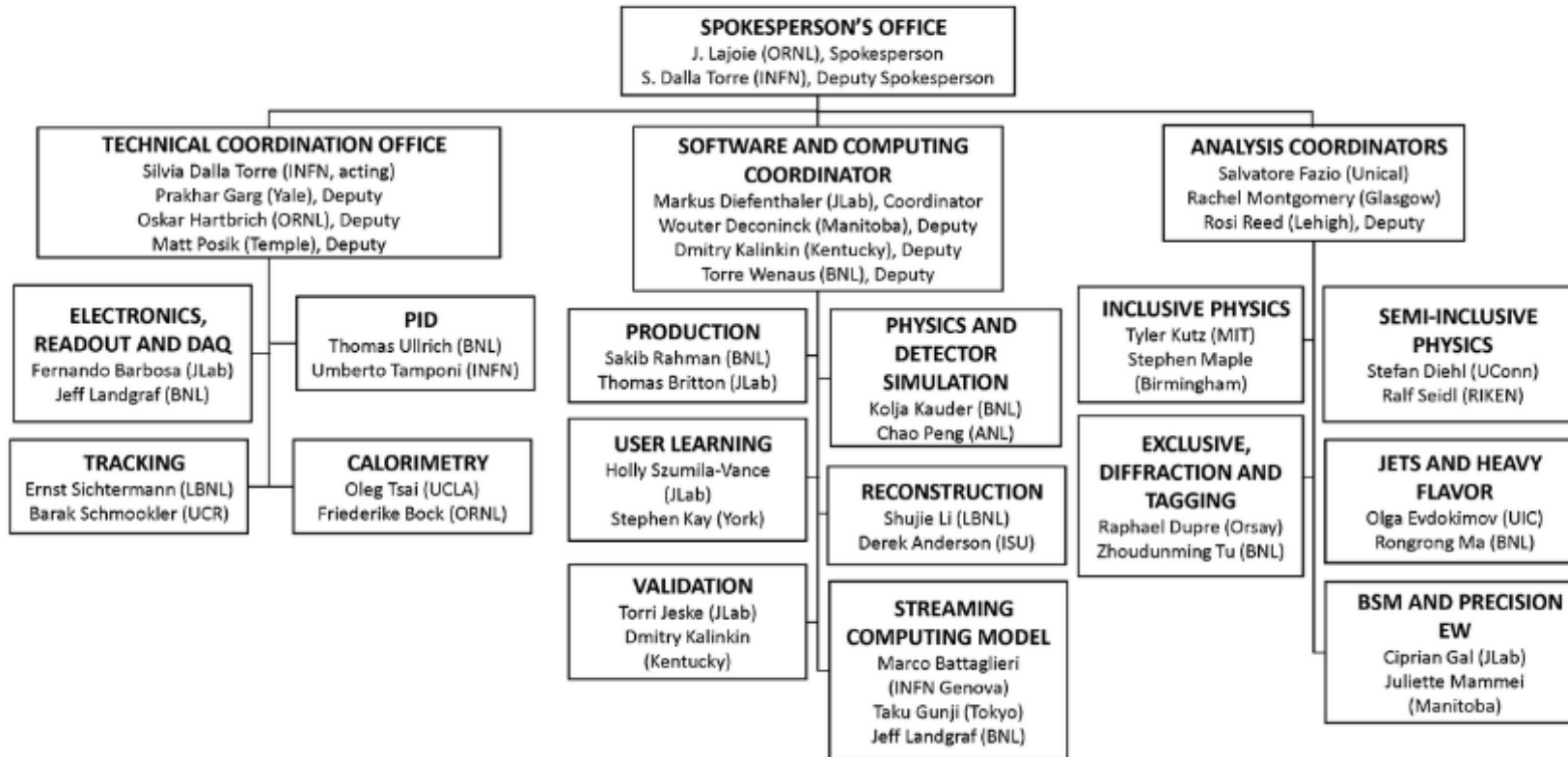
All our participants are welcome to have their inputs !

Other suggestions are greatly appreciated !

Structure of ePIC

Physics working groups shown in particular

The management structure of the ePIC Collaboration is built around three *Coordination Offices* - *Technical Coordination*, *Software and Computing* and *Analysis*. The *Coordination Offices* each manage a set of *Working Groups (WGs)*.



Ideas about establishing a Hadron Spectroscopy Working Group at the EIC

- 1) A suggestion to establish a hadron spectroscopy working group
- 2) Partially may be related to the ePIC Collaboration
- 3) Why partially ? Because it would be essential to also have theory contribution
- 4) Suggested conveners:
 - one experimentalist: physics/detector simulation and/or MC generator expert
 - one experimentalist: spectroscopy data analysis expert
 - one theorist who does calculations and modeling for spectroscopy
- 5) Having the corresponding website, community subscribed to email list, and for now meetings per 3-4 months
- 6) For instance, after having sufficient good results on simulations for heavy meson spectroscopy
 - write an experimental paper for the ePIC Collaboration
 - the paper should pass all the rigorous steps of the collaboration before sending it to publication
- 7) Hadron spectroscopy community interested in EIC-related studies, especially, our workshop's participants will be notified about all important developments

A possible (indirect) supplement to the idea of the White Paper

https://www.mdpi.com/journal/universe/special_issues/YBN53EG190

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A special issue of *Universe* (ISSN 2218-1997). This special issue belongs to the section "High Energy Nuclear and Particle Physics".

Deadline for manuscript submissions: **30 November 2025** | Viewed by 339

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Special Issue Editors



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Guest Editor

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Interests: quantum chromodynamics; QCD



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Guest Editor

Department of Physics and Astronomy, Mississippi State University, Starkville, MS 39762, USA

Interests: nuclear physics; meson production; strong interaction



A possible (indirect) supplement to the idea of the White Paper

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Special Issue Information

Dear Colleagues,

The exploration of the structure of the nucleons and nuclei is essential for all aspects of the physics programs of the current/future electron-hadron and electron-ion colliders, based on using medium- and high-energy electron and proton/ion beams, providing ultimate tools for high-precision studies in Quantum Chromodynamics. Such colliders are the US Electron-Ion Collider (EIC) currently under construction at BNL, the proposed CERN's Large Hadron electron Collider (LHeC) and Electron-Ion Collider in China (EicC), as well as the Future Circular lepton-hadron Collider (FCC-eh), plus the current 12 GeV CEBAF and its potential energy upgrade at Jlab. All these machines are supposed to be excellent laboratories for carrying out studies in many branches of modern nuclear physics, including hadron spectroscopy. The prospective experimental measurements along with theoretical and phenomenological research in hadron spectroscopy will have a major impact, particularly, on our more comprehensive and thorough understanding of non-conventional (exotic) and conventional states that are studied for already several decades in electron-positron annihilation experiments worldwide.

Currently, there are various topics relevant to the spectroscopy programs, which could be of great importance for this Special Issue, including but not limited to

(i) Heavy quarkonium production theory, (ii) XYZ production theory, (iii) XYZ structure and theoretical interpretation, (iv) partial-wave analysis, (v) hadron spectroscopy with lattice QCD.

Some more specific examples are

- Studies of photo- and electroproduction in exclusive, semi-inclusive and inclusive processes that can produce XYZ, multiquark, and baryon-antibaryon molecular states, as well as charm/bottom meson and charmonium/bottomonium states.
- Development of a systematic approach to scattering theory for production and decay of heavy-quark resonances; further development of the mechanisms/models for exotic states' production.
- Studies of exclusive hadron production and hadronization through heavy-flavor production.
- Studies for conventional and exotic hadrons; calculations of scattering amplitudes in certain channels, where exotic candidates may potentially be observable.

Thereby, our goal is to take a "snapshot" of the present developments, by assembling novel research articles and comprehensive reviews related to the above-mentioned and various other spectroscopy-related potential topics for the current/future electron-hadron and electron-ion colliders. We cordially invite contributions of theoretical and phenomenological nature (including physics simulations as well) from our colleagues working in this broad field of research of modern nuclear physics.

Dr. Vladimir Khachatryan

Dr. Wenliang Li

Guest Editors



Epic (ePIC) music section will be back for the potential 3rd workshop

Apr 14 – 17, 2025
CFNS, Stony Brook University
America/New_York timezone

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**Greetings from the three conveners of the
universal international advisory committee !**



Thanks !