

# US Nuclear Science Advisory Committee (NSAC)

*IUPaP WG9*

*June 3, 2023*

*Gail Dodge*



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**OLD DOMINION**  
UNIVERSITY

## Nuclear Data Charge

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- Charge received by NSAC on April 13, 2022
- “assess the challenges, opportunities, and priorities for effective stewardship of nuclear data.”
- Two reports have been finalized. Available at links here:  
<https://science.osti.gov/np/nsac/Reports>
  - [Report 1](#): assessment of the status of the US Nuclear Data Program (USNDP), including accomplishments and needs in basic science and several key applications
  - [Report 2](#): challenges to nuclear data stewardship and a strategic plan to guide federal investment in USNDP



## Nuclear Data Recommendations

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### Core USNDP capabilities

- Support nuclear structure evaluation workforce to improve the currency, consistency, and accessibility of Evaluated Nuclear Structure Data File (ENSDF)
- Nuclear reaction evaluation in support of the Evaluated Nuclear Data File (ENDF); expand workforce; integrate HPC, automation, machine learning
- Establish recommended values for fundamental nuclear properties (e.g., Atomic mass evaluations)



## Nuclear Data Recommendations (cont)

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### New cross cutting initiatives to address additional nuclear data needs

- Nuclear astrophysics – evaluation and modeling
- Statistical nuclear structure – beyond discrete states
- Fission – cross sections and fragment yields; prompt neutron spectra; neutrino spectra
- Radioactive decay – decay data for targeted nuclides (security, nonproliferation, and medical applications)
- Neutron-induced data reactions and structure (nuclear energy, security, nonproliferation, planetary nuclear spectroscopy)
- Charged particle stopping powers (detector design, space effects, ion beam therapy)
- Expanded reaction modeling – compilation of high-energy and charged particle induced data for space exploration, radionuclide production, and ion beam therapy
- Fusion power – tritium production and materials damage cross sections



## Nuclear Data Recommendations (cont)

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### Modernize and increase efficiency of the nuclear data infrastructure

- New nuclear data formats and nuclear data types to improve access by modern software systems
- Develop artificial intelligence and machine learning tools to improve the nuclear data evaluation process
- Data preservation – infrastructure for use by the entire nuclear science community

Expanded workforce is key!



## Long Range Plan Charge from DOE and NSF to NSAC

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- scope and scientific **challenges** of nuclear physics today
- **Progress** since the last LRP; **impacts** in and out of the field
- Most compelling **scientific opportunities** in next decade
- Strategy for use of existing and planned **capabilities**
- **Required resources and funding** levels to maintain world leadership position
  - New facilities, mid-scale instrumentation, major items of equipment (MIE)
  - **Constant effort, modest growth, CHIPS and Science act authorization**
- **International** coordination and collaborations
- Cross cutting **interdisciplinary** opportunities (interagency, etc)
- Mutually beneficial interactions with other disciplines
- **Integrate efforts to promote a diverse, equitable, and sustainable workforce**



## LRP Writing Committee

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Christine Aidala  
Ani Aprahamian  
Sonja Bacca  
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Lee Bernstein  
Joe Carlson  
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Daniel Tapia Takaki  
Derek Teaney  
Brent VanDevender  
Ramona Vogt  
Nathalie Wall

Fred Wietfeldt  
John Wilkerson  
Richard Wilson  
Lindley Winslow  
Sherry Yennello  
Xiaochao Zheng

**International Observers:**  
Marek Lewitowicz (NuPECC)  
Byungsik Hong (ANPhA)



## The Long Range Plan Process

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- Charge delivered to NSAC on July 13
- Committee formed
- DNP named conveners to organize three townhalls
  - QCD Sept. 23– 25 (MIT)
  - Nuclear Structure, Reactions, & Astrophysics Nov. 14 - 16 (Argonne)
  - Fundamental Symmetries Dec. 13 – 15 (Chapel Hill)
- Additional groups also produced white papers
- White papers due Feb. 28
- Rollout planning Initiated
- Public facing website: [NuclearScienceFuture.org](https://NuclearScienceFuture.org)
- LRP Committee works on writing the bulk of the document
- Resolution Meeting: July 10 – 14 in person (set priorities for the community)
- Finish Report, executive summary, communication plan

Initial report due to DOE and NSF by October 2023



## Goals

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- Answer the charge; recommend scientific priorities for the next 10 years
- Produce a readable report that
  - Summarizes the incredible science
  - Clearly articulates the impact (world leadership, interdisciplinary, HEP, applications, workforce, etc)
  - Helps **DOE and NSF leaders** understand and make the case for investment in nuclear science
  - Informs **congress** (staffers)

We need to keep in mind the audience!



## Subcommittees (Chairs)

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- **QCD** (Richard Milner)
- **Fundamental Symmetries** (Brent VanDevender)
- **Nuclear Structure, Reactions & Astrophysics** (Ani Aprahamian)
- **Workforce Development** (Shelly Lesher)
  - includes education and DEI
- **Applications** (Calvin Howell and Mike Carpenter)
- **International Context** (Krishna Kumar)
- **Crosscutting/interdisciplinary scientific opportunities** (Ian Cloet)
  - QIS, AI/ML, Accelerator Science
- **Impact and synergies with other fields** (Jorge Piekarewicz)
- **Budget** (Sherry Yennello)
- **Theory** (Filomena Nunes)
- **Facilities** (Haiyan Gao)



## Outline for LPR report

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- Executive Summary
- The Story of Nuclear Physics
- QCD
- Nuclear Structure and Reactions
- Nuclear Astrophysics
- Fundamental Symmetries, Neutrons, and Neutrinos
- Theory
- Workforce
- Facilities
- Emerging Technologies and Innovation
- Applications
- Budgets

We hope to have QR codes and links in the LRP that will lead to a permanently maintained site with additional content, videos, simulations, etc.



## Ongoing

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- Understand the budget
  - We invited the community to submit budget requests
  - We will ultimately use the budget envelope defined by the CHIPS and Science Act to define our priorities
  - Must also consider constant effort and modest growth
- Workforce
  - Gathered statistics; survey graduate students; salary information
  - Estimate the cost of funding existing people at an adequate level
  - Additional funds needed for research budget to do the outstanding science
- Initiate task force on Communication/Rollout
- Settle agenda for July resolution meeting
- Identify reviewers/science writers/graphics

