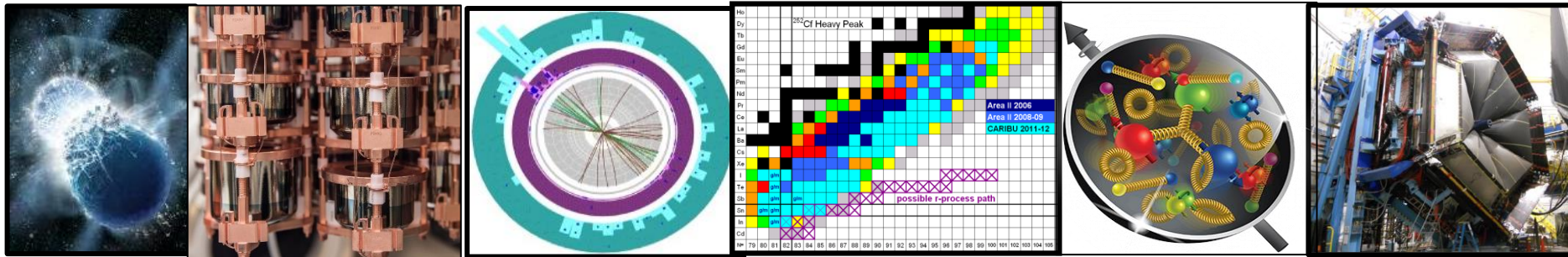




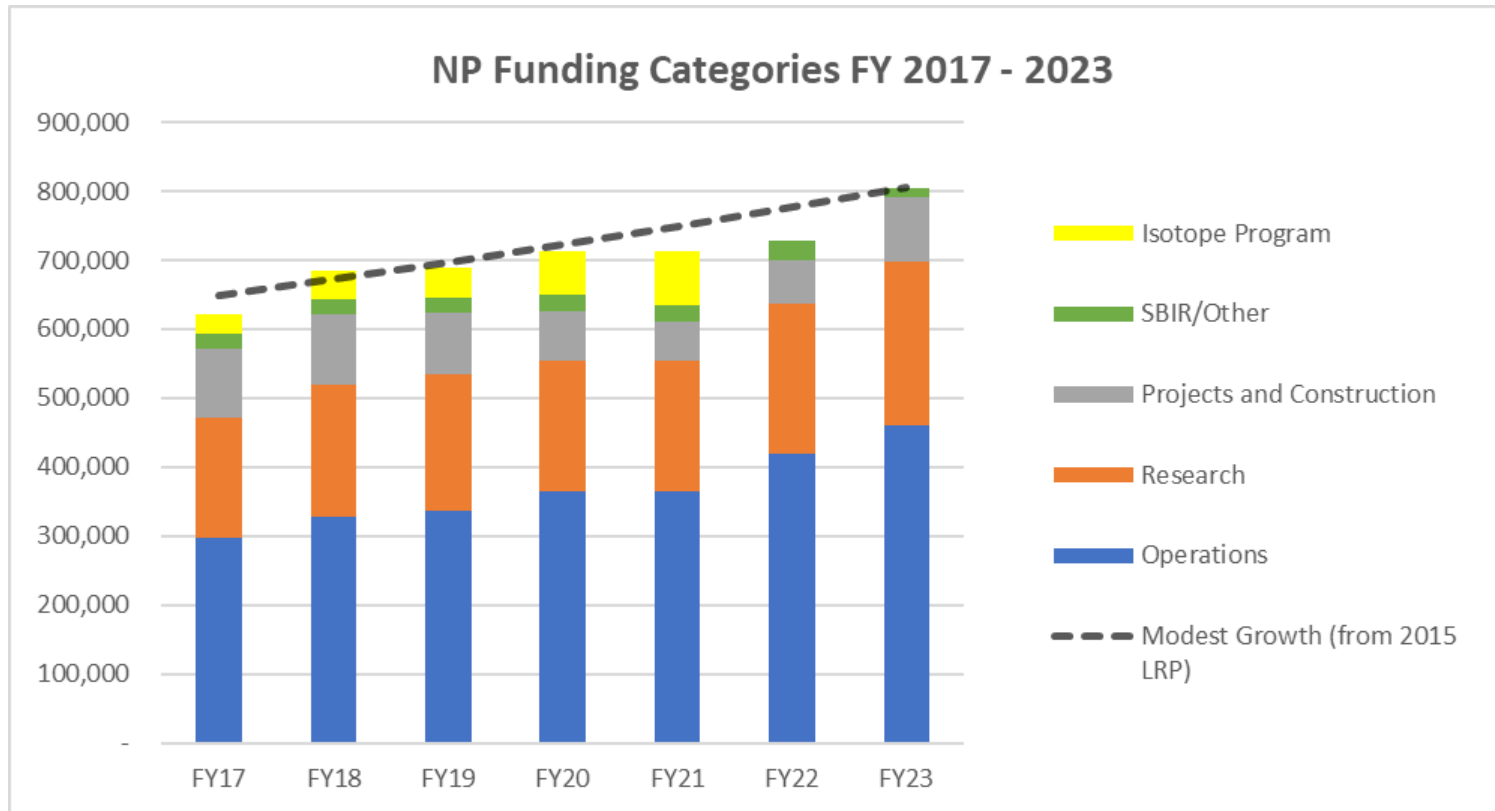
## Perspectives from DOE Nuclear Physics

NSAC Meeting  
March 7, 2023

Dr. Timothy J. Hallman  
Associate Director of the Office of Science  
for Nuclear Physics



# The Trend of Appropriations Supporting the NP Work Plan



Ops increases in recent years largely due to bringing FRIB online and making reliability upgrades at CEBAF

CHIPS and Science Act Authorization Targets Useful Guidance For the Next LRP

# DOE NP Funding

|                                     | FY22 Enacted   | FY 2023 Enacted | FY 2023 Enacted vs FY 2022 Enacted |                |
|-------------------------------------|----------------|-----------------|------------------------------------|----------------|
| <b>Nuclear Physics</b>              |                |                 |                                    |                |
| Medium Energy, Research             | 53,404         | 59,083          | +5,679                             | 10.63%         |
| Medium Energy, Operations           | 142,709        | 149,834         | +7,125                             | 4.99%          |
| <b>Total, Medium Energy Physics</b> | <b>196,113</b> | <b>208,917</b>  | <b>+12,804</b>                     | <b>6.53%</b>   |
| Heavy Ion, Research                 | 46,505         | 46,149          | -356                               | -0.77%         |
| Heavy Ion, Operations               | 183,943        | 182,087         | -1,856                             | -1.01%         |
| Heavy Ion, Projects                 | 25,013         | 20,000          | -5,013                             | -20.04%        |
| <b>Total, Heavy Ion Physics</b>     | <b>255,461</b> | <b>248,236</b>  | <b>-7,225</b>                      | <b>-2.83%</b>  |
| Low Energy, Research                | 78,807         | 83,492          | +4,685                             | 5.94%          |
| Low Energy, Operations              | 102,959        | 122,738         | +19,779                            | 19.21%         |
| Low Energy, Projects                | 17,400         | 23,940          | +6,540                             | 37.59%         |
| <b>Total, Low Energy Physics</b>    | <b>199,166</b> | <b>230,170</b>  | <b>+31,004</b>                     | <b>15.57%</b>  |
| Theory, Research                    | 57,260         | 67,873          | +10,613                            | 18.53%         |
| <b>Total, Nuclear Theory</b>        | <b>57,260</b>  | <b>67,873</b>   | <b>+10,613</b>                     | <b>18.53%</b>  |
| <b>Subtotal, Nuclear Physics</b>    | <b>708,000</b> | <b>755,196</b>  | <b>+47,196</b>                     | <b>6.67%</b>   |
| 20-SC-52, EIC                       | 20,000         | 50,000          | +30,000                            | 150.00%        |
| <b>Subtotal, Construction</b>       | <b>20,000</b>  | <b>50,000</b>   | <b>+30,000</b>                     | <b>150.00%</b> |
| <b>Total, Nuclear Physics</b>       | <b>728,000</b> | <b>805,196</b>  | <b>+77,196</b>                     | <b>10.60%</b>  |

**Net increase in NP initiatives is +12M**

# NP Enacted Appropriations FY 19-23

|                           | <b>FY 2019</b> | <b>FY 2020</b> | <b>FY 2021</b> | <b>FY 2022</b> | <b>FY 2023</b> |
|---------------------------|----------------|----------------|----------------|----------------|----------------|
| Operations                | 334,570        | 362,980        | 364,529        | 418,349        | 460,500        |
| Core Research             | 192,706        | 184,188        | 172,946        | 199,746        | 206,103        |
| Initiatives Research      | 6,800          | 6,800          | 17,347         | 19,421         | 31,384         |
| Projects and Construction | 88,000         | 73,120         | 56,480         | 62,413         | 93,940         |
| SBIR/Other                | 23,665         | 24,412         | 23,698         | 28,071         | 13,269         |
| Isotope Program           | 44,259         | 61,500         | 78,000         | -              | -              |
| <b>Total, NP</b>          | <b>690,000</b> | <b>713,000</b> | <b>713,000</b> | <b>728,000</b> | <b>805,196</b> |

Approximately 60% of the increase in FY 2023 is EIC funding and FRIB Ops. All facilities operate at or above 96% of optimal funding in FY 2023. Increases for initiatives constitutes an additional 15%.

Research is constrained. One example of a target of opportunity for increased research funding which is challenging to address at the moment is atomic EDMs at FRIB



# NP Participation in SC Initiatives

| SC/DOE Initiatives                                      | FY21 Enacted | FY22 Enacted | FY23 Enacted |
|---|--------------|--------------|--------------|
| Quantum Information Sciences (QIS)                      | 13,347       | 10,866       | 10,866       |
| Artificial Intelligence and Machine Learning (AI/ML)    | 4,000        | 4,000        | 8,000        |
| Microelectronics  | -            | 518          | 518          |
| Strategic Accelerator Science and Technology Initiative | -            | 1,037        | -            |
| Reaching a New Energy Sciences Workforce (RENEW)        | -            | 3,000        | 6,000        |
| Funding for Accelerated, Inclusive Research (FAIR)      | -            | -            | 2,000        |
| Accelerate Innovations in Emerging Technologies         | -            | -            | 4,000        |

|   |          |          |          |
|---|----------|----------|----------|
| Scientific Discovery Through Advanced Computing | \$ 2,878 | \$ 3,543 | \$ 3,543 |
| NP EPSCoR                                       | \$ -     | \$ -     | \$ 2,000 |

NP is also cultivating the possibility of a symbiosis with NIH to spark a new advance in imaging useful for both DOE and NIH research

# Inflation Reduction Act Funding for NP

| Project | Lab   | B&R       | BRN | Funds         |
|---------|-------|-----------|-----|---------------|
| EIC     | BNL   | KB9503000 | LIC | \$ 96,180,000 |
| EIC     | BNL   | KB0203011 | OPE | \$ 9,000,000  |
| EIC     | TJNAF | KB9503000 | LIC | \$ 32,060,000 |
| EIC     | TJNAF | KB0203011 | OPE | \$ 1,000,000  |
| GRETA   | LBNL  | KB0406011 | EQU | \$ 7,700,000  |
| MOLLER  | TJNAF | KB0406013 | EQU | \$ 31,100,000 |
| MOLLER  | TJNAF | KB0406013 | OPE | \$ 120,000    |

Distributed in October 2022

NLDBD: \$8M+

HRS at FRIB: \$29.67M



# NP Projects: Status and Operations Plan

| Project   | Location | Status | Cost                | CPI  | SPI  | CD-4    | Operation cost plan  |
|---|----------|--------|---------------------|------|------|---------|--|
| <b>Construction Projects</b>  |          |        |                     |      |      |         |  |
| Facility for Rare Isotope Beams (FRIB)                                | MSU      | CD-4   | \$730M              | 1.00 | 1.00 | 6/2022  | Included in NP budget formulation  |
| Electron-Ion Collider (EIC)   | BNL      | CD-1   | \$1.7B to \$2.8B    |      |      | Q4 FY33 | RHIC operations funds redirected to EIC project recovered for EIC operations |
| <b>Major Items of Equipment</b>                                       |          |        |                     |      |      |         |  |
| Gamma Ray Energy Tracking Array (GRETA)                               | LBNL     | CD-2/3 | \$58.3M             | 1.00 | 1.01 | 4/2028  | Mostly covered by host laboratory operations experimental support            |
| Super Pioneering High Energy Nuclear Interaction Experiment (SPHENIX) | BNL      | PD-4   | \$26.5M             | 1.00 | 1.00 | 12/2022 | Covered by RHIC operations experimental support                              |
| Measurement of Lepton-Lepton Electroweak Reactions (MOLLER)           | TJNAF    | CD-1   | \$45.8M to \$56.6M  |      |      | Q4 FY27 | Covered by TJNAF operations experimental support                             |
| High Rigidity Spectrometer (HRS)                                      | MSU      | CD-1   | \$85.0M to \$111.4M |      |      | Q2 FY29 | Covered by FRIB operations experimental support                              |
| Ton Scale Neutrinoless Double Beta Decay (TS-NLDBD)                   | TBD      | CD-0   | \$215M to \$250M    |      |      | TBD     | TBD  |

Blue indicates “Completed”, Chartreuse “Fully Funded”, and orange, “Substantially Funded”

# FRIB Continues to Make Great Strides



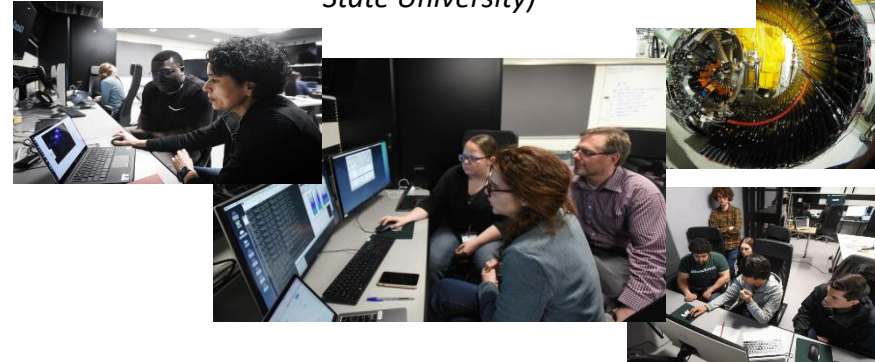
Secretary Granholm at the  
FRIB Ribbon Cutting

May 2, 2022

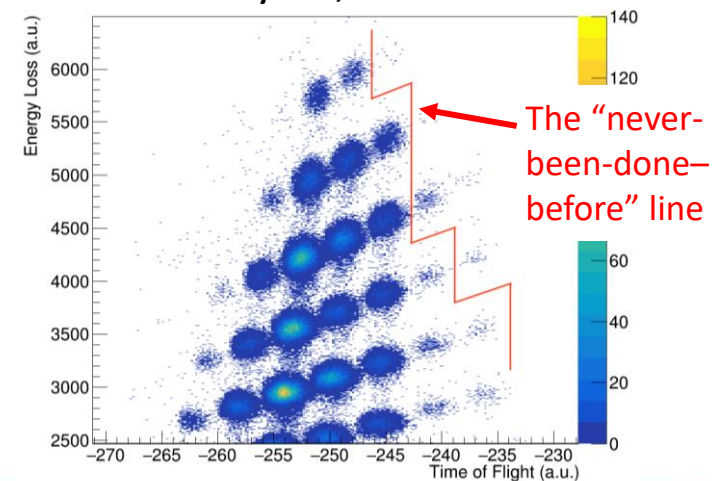


## FRIB Experiment E21062

**Spokespersons:** *J. Allmond (ORNL), H. Crawford (LBNL), B. Crider (Mississippi State University), R. Grzywacz (University of Tennessee Knoxville) and V. Tripathi (Florida State University)*



May 19, 2022





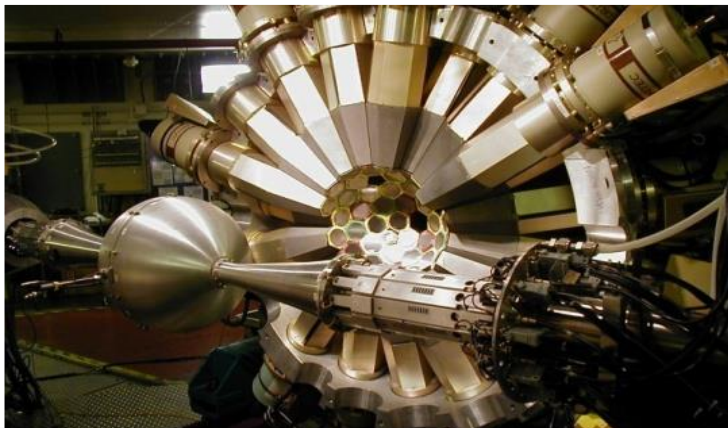
# As Do All NP User Facilities



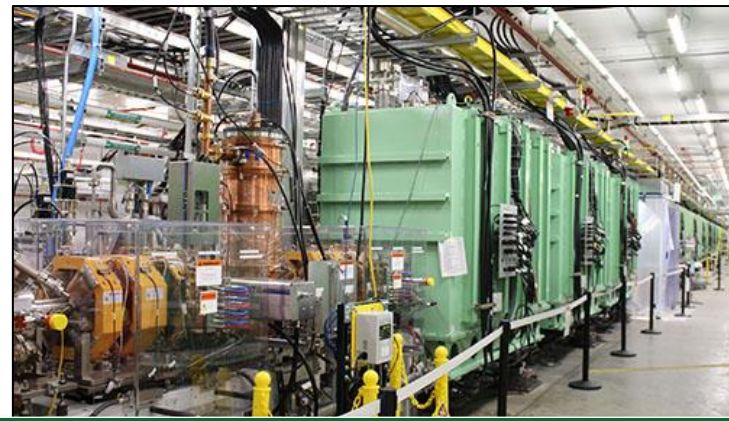
*Relativistic Heavy Ion Collider*



*Continuous Electron Beam Accelerator Facility*



*Argonne Tandem Linac System*



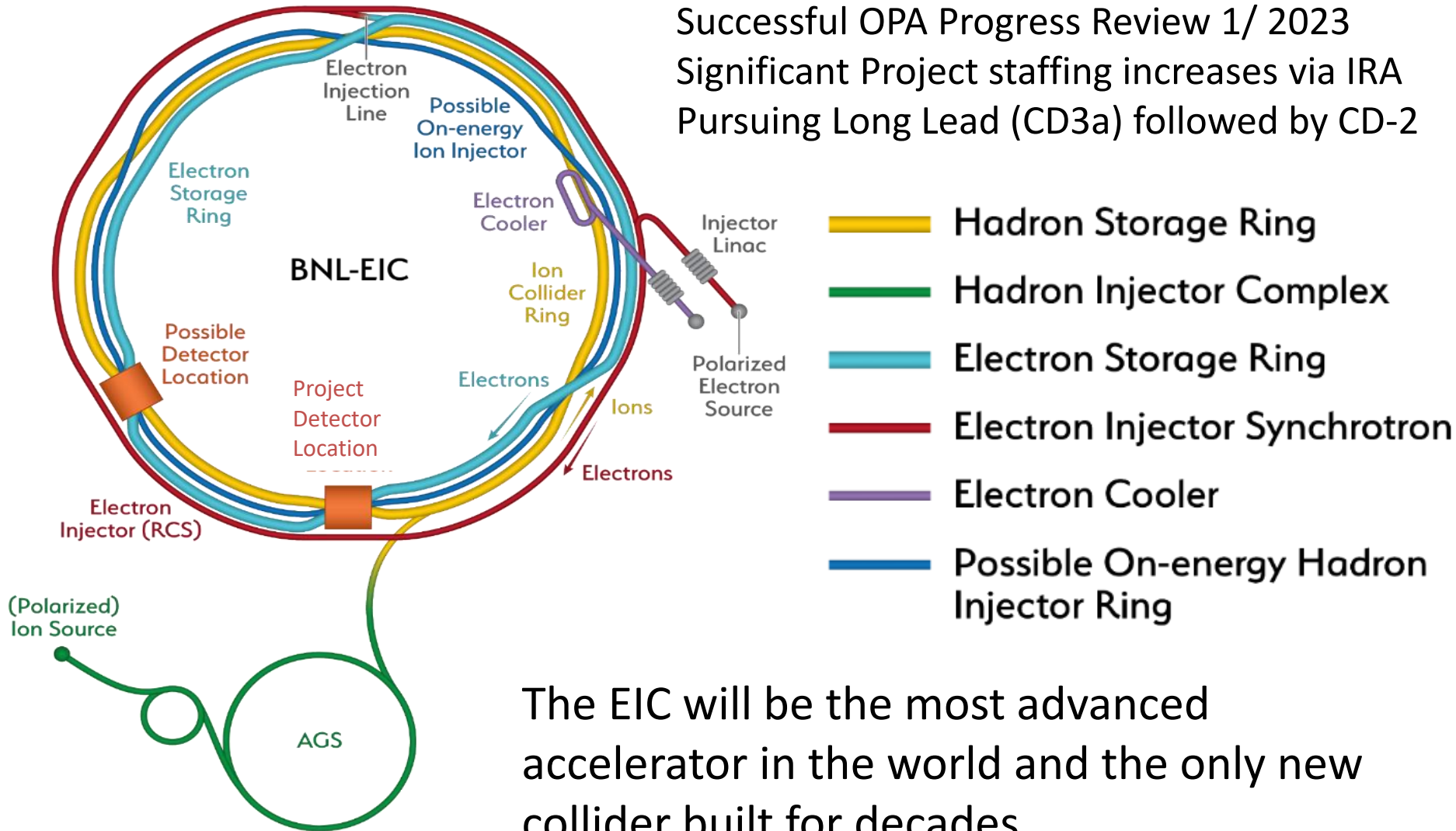
*Facility for Rare Isotope Beams*

“Microscopes” of Varying Resolving Power



# Progress Continues on the Electron-Ion Collider

Successful OPA Progress Review 1/ 2023  
 Significant Project staffing increases via IRA  
 Pursuing Long Lead (CD3a) followed by CD-2



The EIC will be the most advanced accelerator in the world and the only new collider built for decades

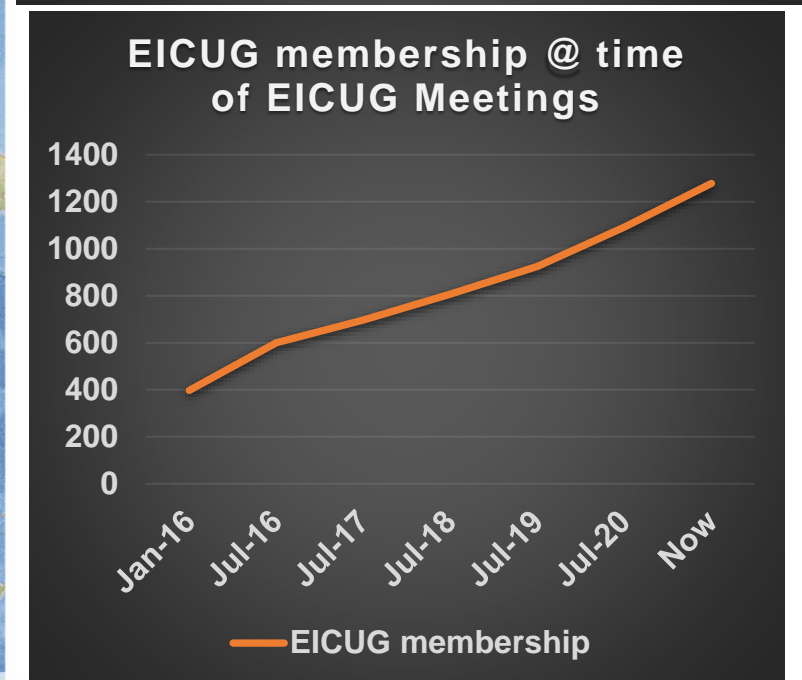
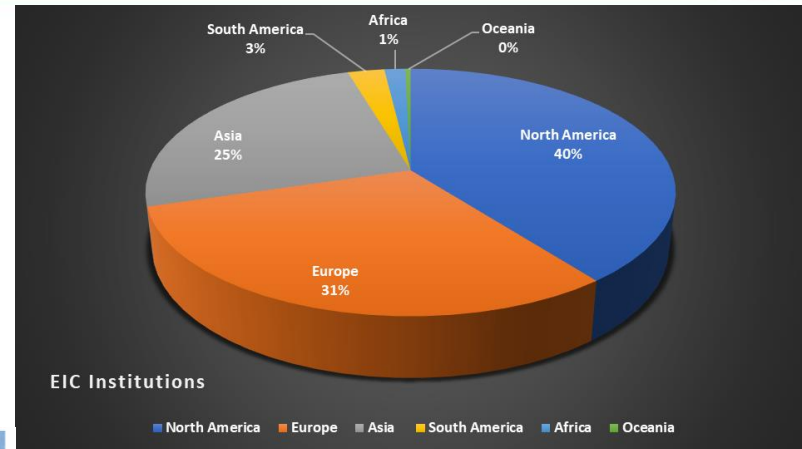
# The EIC is International At Its Core

EIC Users Group Formed in 2016

[EICUG.ORG](http://EICUG.ORG)

Status January 2023:

- Collaborators 1379
- Institutions 269
- Countries 36



# And the Governance is Being Envisioned Accordingly

## The EIC Advisory Board

| Name                    | Affiliation          |
|-------------------------|----------------------|
| Stuart Henderson, Chair | TJNAF, USA           |
| Diego Bettoni           | INFN, Italy          |
| Paul Kearns             | ANL, USA             |
| Mike Lamont             | CERN, Switzerland    |
| Reynald Pain            | IN2P3/CNRS, France   |
| Franck Sabatié          | CEA, France          |
| Nigel Smith             | TRIUMF, Canada       |
| Mark Thomson            | STFC, United Kingdom |
| Mike Witherell          | LBNL, USA            |

First EIC Resource Review Board for Discussion of International Contributions is Upcoming

# First EIC Resource Review Board To Discuss International Contributions

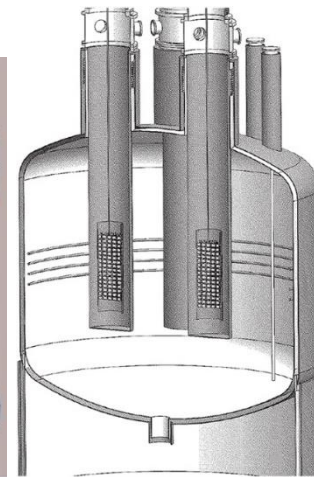
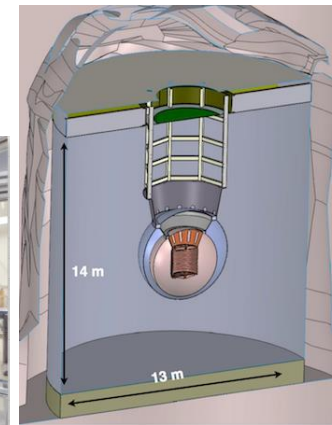
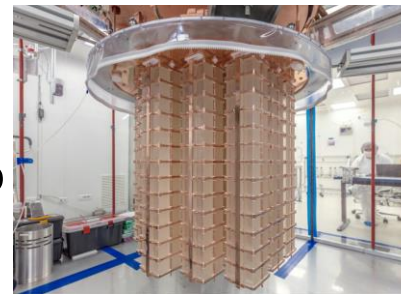
| Name               | Affiliation   | Country        | Funding Agency/ PI |
|--------------------|---|----------------|--------------------|
| Hayotsyan, Sargis  | State Science Committee of Armenia  | Armenia        | Funding Agency     |
| Samson, Claire     | Canada Foundation for Innovation (CFI)  | Canada         | Funding Agency     |
| Vyšinka ,Marek     | Ministry of Education, Youth and Sports   | Czech Republic | Funding Agency     |
| Sabatie, Franck    | Institut de Recherche sur les Lois Fondamentales de l'Univers (Irfu-SPhN), CEA-Saclay | France         | Funding Agency     |
| Grasso, Marcella   | IN2P3/CNRS  | France         | Funding Agency     |
| Lucotte, Arnaud    | IN2P3/CNRS  | France         | Funding Agency     |
| Bettoni, Diego     | Instituto Nazionale de Fisica Nucleare (INFN)   | Italy          | Funding Agency     |
| Nania, Rosario     | Instituto Nazionale de Fisica Nucleare (INFN)   | Italy          | Funding Agency     |
| Moon, Young Kun    | Research Promotion Division at the Ministry of Science and ICT                        | Korea          | Funding Agency     |
| Gaczyński, Mateusz | Department of Innovation and Development, Ministry of Science and Higher Education    | Poland         | Funding Agency     |
| Ka, Oumar          | Cheikh Anta Diop University   | Senegal        | N/A                |
| Nxomani, Clifford  | National Research Foundation  | South Africa   | Funding Agency     |
| Blaire, Grahme     | UK Science and Technology Facilities Council (STFC)                                   | United Kingdom | Funding Agency     |
| Hiscock, Jenny     | UK Science and Technology Facilities Council (STFC)                                   | United Kingdom | Funding Agency     |
| Hallman, Timothy   | DOE Office of Nuclear Physics   | United States  | Funding Agency     |

# Measured Progress Continues On The Global Campaign to Determine the Fundamental Nature of the Neutrino

- Between IRA funding and NP Program Funding, approximately \$12.8 M allocated to the three experiments LEGEND 1000, nEXO, and CUPID since FY 2020.
- Additional resources provided by international partners
- Geo-political impact on isotope procurement a severe problem
- The next DBD summit is April 27, 2023; Would a virtual “Global DBD Laboratory” be an idea?
- DOE NP is thinking about options to demonstrate proof of principle isotope procurement test

## Three Proposed Technologies


- Scintillating bolometry (**CUPID**,  $^{100}\text{Mo}$  enriched  $\text{Li}_2\text{Mo}_4$  crystals)
- Enriched  $^{76}\text{Ge}$  crystals (**LEGEND-1000**, drifted charge, point contact detectors )
- Liquid Xenon TPC (**nEXO**, light via SiPM, drifted ionization)



Potential Partners: Italy, Canada, and Germany

# Funding Opportunities for Nuclear Data Continue

PROGRAM ANNOUNCEMENT  
TO DOE NATIONAL LABORATORIES



U. S. Department of Energy  
Office of Science  
Nuclear Physics

Nuclear Data Interagency Working Group / Research Program

DOE National Laboratory Announcement Number: LAB 17-1763  
Announcement Type: Initial

Issue Date: 04/26/2017


Letter of Intent Due Date: 05/12/2017 at 5 PM Eastern Time  
*A Letter of Intent is required.*

Encourage/Dis courage Date: 05/26/2017 at 5 PM Eastern Time

Application Due Date: 07/21/2017 at 5 PM Eastern Time

**FY17**

DEPARTMENT OF ENERGY  
OFFICE OF SCIENCE  
NUCLEAR PHYSICS



NUCLEAR DATA INTERAGENCY WORKING GROUP  
(NDIAWG) RESEARCH PROGRAM


FUNDING OPPORTUNITY ANNOUNCEMENT (FOA) NUMBER:  
DE-FOA-0002440

FOA TYPE: INITIAL  
CFDA NUMBER: 81.049

|  |   |
|--|---|
| FOA Issue Date:                            | December 7, 2019  |
| Submission Deadline for Letters of Intent: | January 7, 2021 at 5 PM Eastern Time (A Letter of Intent is required) |
| Letter of Intent Response Date:            | January 31, 2021 at 5 PM Eastern Time                                 |
| Submission Deadline for Applications:      | March 5, 2021 at 5 PM Eastern Time                                    |

**FY18**

DEPARTMENT OF ENERGY (DOE)  
OFFICE OF SCIENCE (SC)  
NUCLEAR PHYSICS (NP)



**FY23**


NUCLEAR DATA INTERAGENCY WORKING GROUP  
(NDIAWG) RESEARCH PROGRAM

FUNDING OPPORTUNITY ANNOUNCEMENT (FOA) NUMBER:  
DE-FOA-0002952

FOA TYPE: Initial  
CFDA NUMBER: 81.049

|  |  |
|--|--|
| FOA Issue Date:                            | February 1, 2023   |
| Submission Deadline for Letters of Intent: | March 1, 2023 at 5:00pm Eastern Time<br>A Letter of Intent is required.<br>Letters of Intent must be submitted by an authorized institutional official |
| Letter of Intent Response Date             | March 15, 2023, at 11:59pm Eastern Time  |
| Submission Deadline for Applications:      | May 2, 2023 at 11:59pm Eastern Time  |

DEPARTMENT OF ENERGY  
OFFICE OF SCIENCE, NUCLEAR PHYSICS  
OFFICE OF SCIENCE, NUCLEAR PHYSICS, ISOTOPES PROGRAM  
OFFICE OF NUCLEAR ENERGY  
NATIONAL NUCLEAR SECURITY ADMINISTRATION, OFFICE OF  
DEFENSE NUCLEAR NONPROLIFERATION R&D



**FY19**


NUCLEAR DATA INTERAGENCY WORKING GROUP /  
RESEARCH PROGRAM

FUNDING OPPORTUNITY ANNOUNCEMENT (FOA) NUMBER:  
DE-FOA-0002114

FOA TYPE: INITIAL  
CFDA NUMBER: 81.049

|  |   |
|--|---|
| FOA Issue Date:                            | April 19, 2018  |
| Submission Deadline for Letters of Intent: | May 15, 2018, at 5 PM Eastern<br>A Letter of Intent is required |
| Application Encouragement Date:            | June 1, 2019, at 5 PM Eastern                                   |
| Submission Deadline for Applications:      | June 25, 2018, at 5 PM Eastern                                  |

DEPARTMENT OF ENERGY  
OFFICE OF SCIENCE  
NUCLEAR PHYSICS



NUCLEAR DATA INTERAGENCY WORKING GROUP /  
RESEARCH PROGRAM

DOE NATIONAL LABORATORY ANNOUNCEMENT NUMBER:  
LAB 18-1903

ANNOUNCEMENT TYPE: INITIAL

**FY21**

|  |   |
|--|---|
| Announcement Issue Date:                   | March 16, 2018  |
| Submission Deadline for Letter of Intent:  | April 13, 2018, at 5 PM Eastern<br>A Letter of Intent is required |
| Proposal Encouragement/Dis courage Date:   | April 20, 2018, at 5 PM Eastern                                   |
| Submission Deadline for Post-Applications: | N/A   |
| Submission Deadline for Applications:      | June 15, 2018, at 5 PM Eastern                                    |

# NDIAWG Funded Efforts Since 2016

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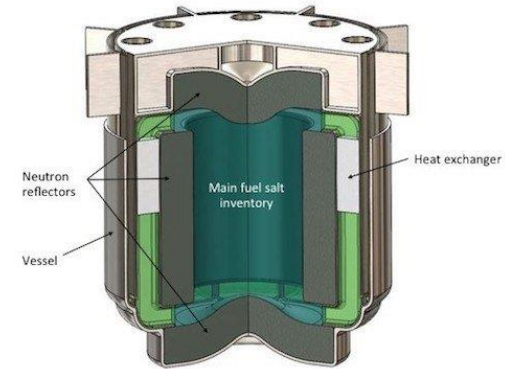
- Total Investment                   \$49,773,881.00
- 23 individual projects
- 8 different lead organizations
- 6 DOE sites (ANL, BNL, LANL, LBNL, LLNL, ORNL)
- 2 universities (Duke, US Naval Academy)
- 14 collaborating orgs
- 6 DOE sites (BNL, LANL, LBNL, LLNL, PNNL, NNSS)
- 8 universities (Duke, Notre Dame, Univ. of Dallas, Mississippi State, Kentucky, NC State, TUNL)



# The NP Line of Sight to Broader Impacts & Other Missions

## NP is providing new and updated nuclear data to existing “customers”

- Working to identify impactful nuclear data needs and leverage resources
  - Ex: Advanced Reactors with DOE/NE, ARPA-E



## NP is reaching out to new nuclear data application customers

- Electronics protection (NASA, Missile Defense Agency, Federal Aviation Administration)
- Human safety (NASA [spaceflight], NIH [ion beam therapy])
- Advanced reactors (ARPA-E, NASA)



## NP is exploring a mechanism for Rapid Response Nuclear Data

- Many federal agencies have projects with nuclear data shortfalls
- Project funding / scope does not cover nuclear data activities
- USNDP is investigating a process where performers can submit requests for urgent, high impact nuclear data needs



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## Diversity, Equity, and Inclusion:

The Office of Science has undertaken a number of steps, underscoring its commitment to a diverse, equitable and inclusive workplace which “looks like America”

# SC Diversity, Equity, and Inclusion Initiatives



Advancing DEI at the DOE National Labs

Promoting DEI in SC's business practices

SC's statement of commitment & PIER

Increasing SC engagement and participation

DOE & interagency coordination

Establishment of the SC SW-DEI Office

**More in the presentation of J. Carruthers**

Acting Director of the Office of Scientific Workforce Diversity, Equity, and Inclusion



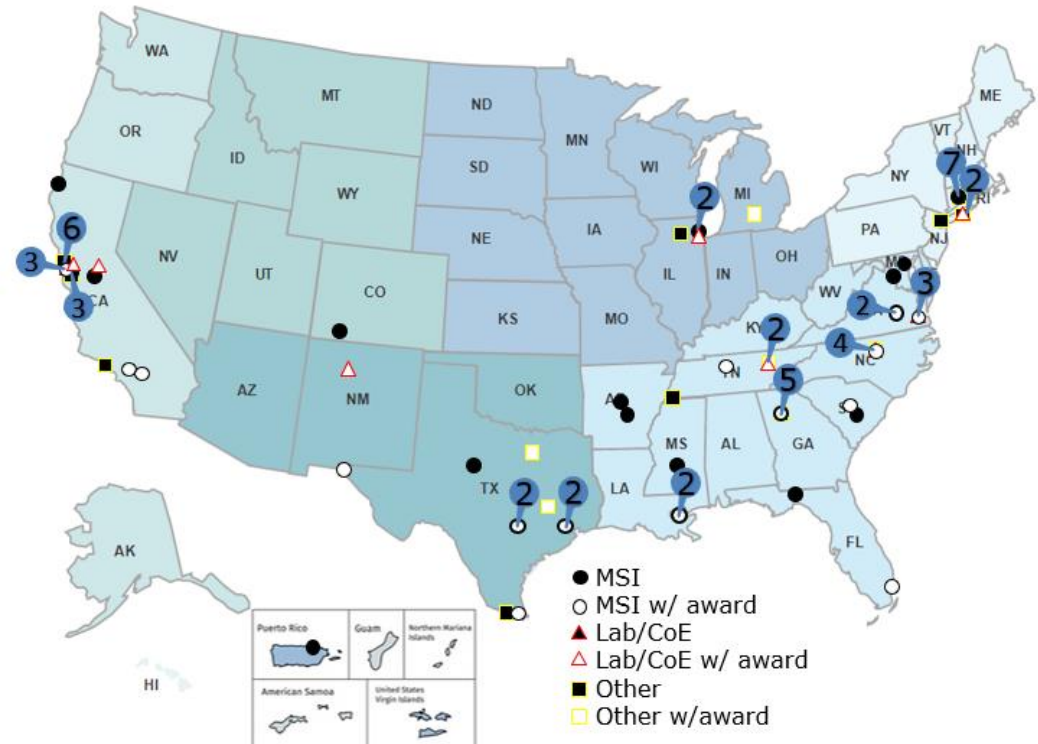
# NP Traineeships: 36 Proposals Resulting in 110 Traineeships

NP traineeship award recipients include:

- 18 MSIs,
- 10 other colleges/universities,
- 5 DOE laboratories

MSI award recipients include:

- 9 Hispanic Serving Institutions (HSIs),
- 8 HBCUs,
- 5 Asian/Native American, and Pacific Islander Serving Institutions (AANAPISI),
- 1 Predominantly Black Institution (PBI)



Other institutions on the map are involved in the traineeship program as recruitment sites (38), Co-Is (9), and/or hosts (7).

Of the funds awarded in FY21, ~ 70% went to MSIs, MSI faculty, or MSI students



# Built-In Plan for Continuous Evaluation & Feedback

“The Institute for Nuclear Science to Inspire the next Generation of a Highly Trained workforce” (INSIGHT)

- Coordinates the NP traineeship effort across all grantees.
- Located at the Facility for Rare Isotope Beams (FRIB), the newest SC user facility.

Responsible for:

- Assessing the effectiveness of the 27 traineeships awarded
- Facilitating communication and coordination between the participating groups
- Surveying students to ascertain race/ethnicity and criteria related to retention, such as socio-economic status

## INSIGHT Team

For teams at the individual traineeship sites other than FRIB, please visit the respective institutional website (see [institutional](#))



Dr. Paul Gueye  
(MSU)

DIRECTOR



Casey Hulbert  
(MSU)

ADMIN SUPPORT



Dr. Felicia Commodore  
(Old Dominion)

EVALUATOR



Steven Thomas  
(MSU)

COACHING PROGRAM



Dr. Hendrik Schatz  
(MSU)

CO-INVESTIGATOR



Dr. Abdullah Darwish  
(Dillard)

CO-INVESTIGATOR



Dr. Filomena Nunes  
(MSU)



Dr. Artemis Spyrou  
(MSU)



Dr. Greg Severin  
(MSU)

# Additional News

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- NP programmatic peer review process is evolving to Comparative Reviews
- Laboratory Research Reviews are being re-started
- Paul Mantica is the new NP Director of Facilities and Projects Division
- A solicitation for a new Director of the NP Physics Research Division will be released in approximately 1 week
- Looking forward to the Long Range Plan Resolution Meeting (Virginia Beach, July)
- Kelsie Krafton has taken a position at the National Academy of Science
- The FY2023 President's Budget Request expected to roll out March 9, 2023
- NP Office Retreat March 29-31, 2023
- Next QIS FOA will be released in FY 2024
- Exploring workable, attractive vehicles for sustained support at MSIs, including HBCUs, HSIs, PBIs, etc., to provide expertise and tech development needed for the SC/NP mission

# DOE Office of Nuclear Physics

**Timothy J. Hallman, Associate Director**

Melissa Emerson, Administrative Specialist (CONTR)

**Associate Director's Office Staff**

Brian Knesel, Financial Management Specialist  
 Dannette Keen, Financial Management Analyst  
 Linnette Quick, Program Assistant (CONTR)  
 Brenda May, Program Analyst  
 Michael Famiano, International Cooperation and Outreach  
 Latifa Elouadrhiri (Detailee), International Outreach

**Physics Research Division**

**VACANT**, Director

Christine Izzo, Program Support Specialist

**Medium Energy & Quantum Information Science**

Gulshan Rai, Technical Advisor  
 Spyridon Margetis (IPA)

**Heavy Ion Nuclear Physics**

Kenneth Hicks

**Nuclear Structure and Nuclear Astrophysics**

Sharon Stephenson

**Nuclear Theory**

Astrid Morreale, Acting  
**VACANT**

**Nuclear Data**

Keith Jankowski

**Fundamental Symmetries**

Paul Sorensen

**Nuclear Physics Computing**

Xiaofeng Guo

**Facilities & Project Management Division**

Paul Mantica, Director

Saryna Cameron, Program Support Specialist (CONTR)

**Advanced Technology R&D**

Manouchehr Farkhondeh, Deputy

**Nuclear Physics Facilities**

David Cinabro

**Nuclear Physics Major Initiatives**

Ivan Graff

**Nuclear Physics Instrumentation**

Elizabeth Bartosz

**Industrial Concepts**

Michelle Shinn

**Research Division**

8 Feds  
 1 IPAs  
 1 AAAS fellow  
 1 Acting  
 2 vacancies

FY 23 Enacted:  
**\$250.8M**

**Facilities & Projects Division**

5 Feds  
 1 IPAs  
 2 Contractors  
 1 Acting  
 1 vacancy

FY 23 Enacted:  
**\$554.4M**

# A Long Tradition of Partnership and Stewardship

There has been a long tradition in Nuclear Science of effective partnership between the community and the agencies in charting compelling scientific visions for the future of nuclear science.

Key factors:

- 1) Informed scientific knowledge as the basis for recommendations and next steps
- 2) Mutual respect among scientific sub-disciplines
- 3) Commitment to the greater good of nuclear science as a discipline
- 4) Meticulously level playing field leading to respect for process and outcomes
- 5) Deep appreciation for the wisdom of Ben Franklin

Staying united we can accomplish great things together



Division will setback the entire field and is the last thing needed right now

## Staying united is crucially important at this moment