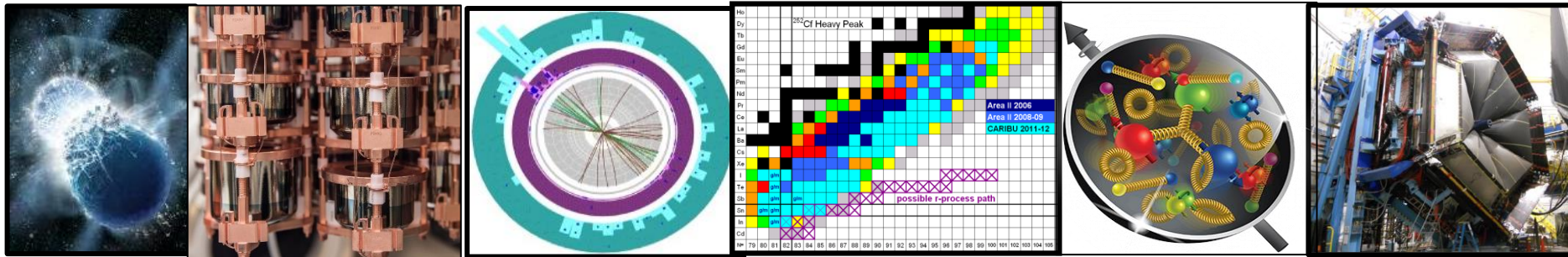




DOE Nuclear Physics Perspectives: Update on Recent Events

NSAC Meeting
September 28, 2022

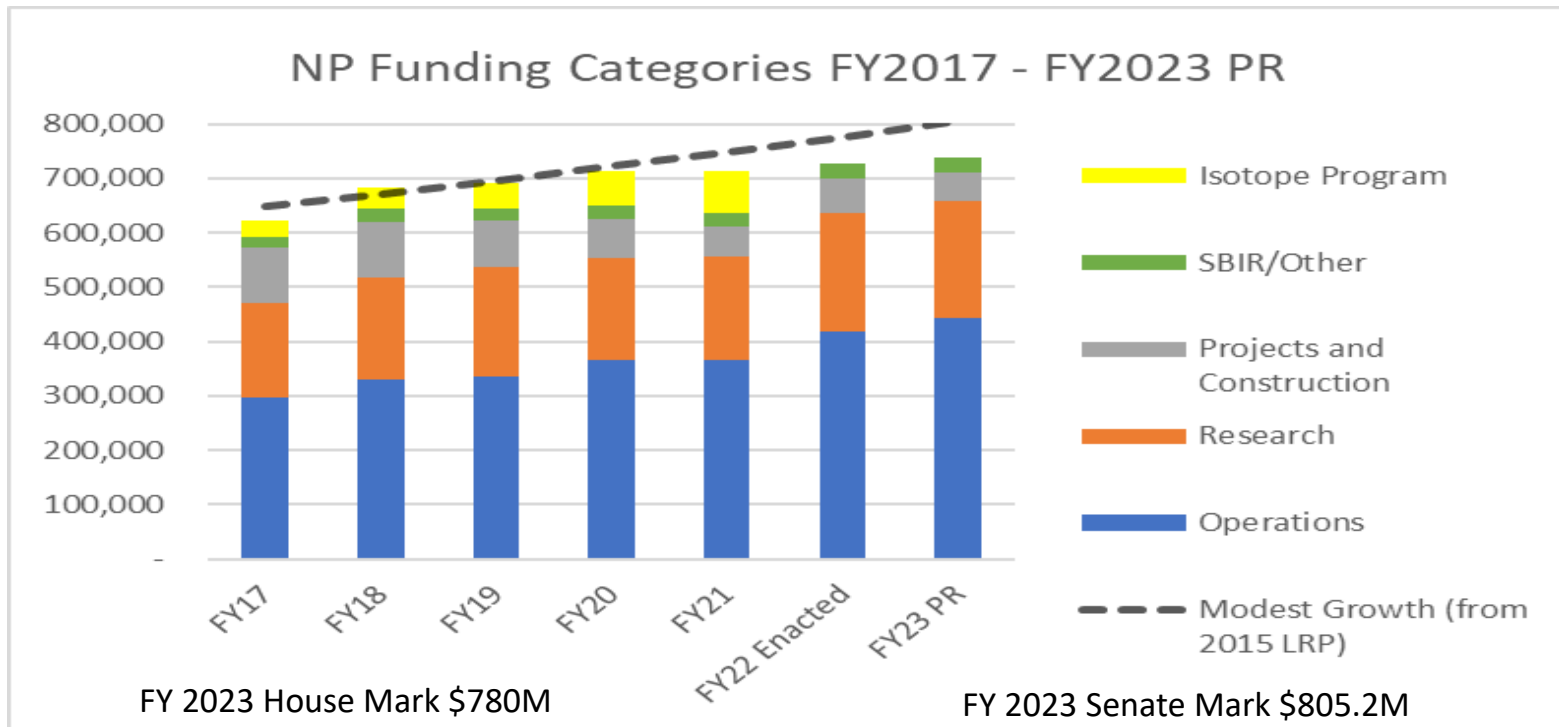
Dr. Timothy J. Hallman
Associate Director of the Office of Science
for Nuclear Physics



Funding



The Trend of Appropriations Supporting the NP Work Plan



Recent Ops increases largely due to bringing FRIB online and making reliability upgrades at CEBAF
 CHIPS and Science Act Authorization Targets Useful Guidance For the Next LRP



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

To go out 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
Construction Projects							
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
Major Items of Equipment							
Gamma Ray Energy Tracking Array (GRETA)	LBNL	CD-2/3	\$58.3M	0.98	0.94	4/2028	Mostly covered by host laboratory operations experimental support
Super Pioneering High Energy Nuclear Interaction Experiment (SPHENIX)*	BNL	PD-3	\$27.0M	1.02	0.85	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”



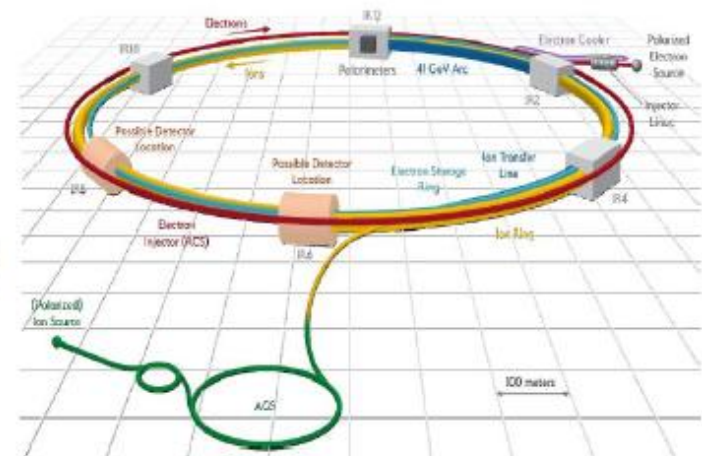
The EIC Project On the Move

Progress Continues on the Electron-Ion Collider

- ▶ Located at BNL and with TJNAF as a major partner. Estimated cost between \$1.7 and \$2.8 billion.
- ▶ Utilizes existing RHIC assets; adds electron storage ring, & electron cooling
- ▶ NAS: A US- based EIC will uniquely answer
 - ▶ How does the mass of the nucleon arise?
 - ▶ How does the spin of the nucleon arise?
 - ▶ What are the emergent properties of dense systems of gluons?"
- ▶ The international community is already highly engaged with over 1350 collaborators, from 36 countries, and 267 institutions actively working on EIC development



CD-1 was attained in June 2021.



The EIC Project continues to target sufficient progress to be prepared for a CD-2 Review in the first half of FY 2024. The timing is important to attempt to avoid a very large RIF and loss of needed skills in FY 2025.

\$ ~90M anticipated detector in-kind (~30%)
\$ ~50M anticipated accelerator in-kind (~5%)
\$100M grant from New York State



U.S. DEPARTMENT OF
ENERGY

Office of
Science

14



U.S. DEPARTMENT OF
ENERGY

Office of
Science

NSAC Meeting

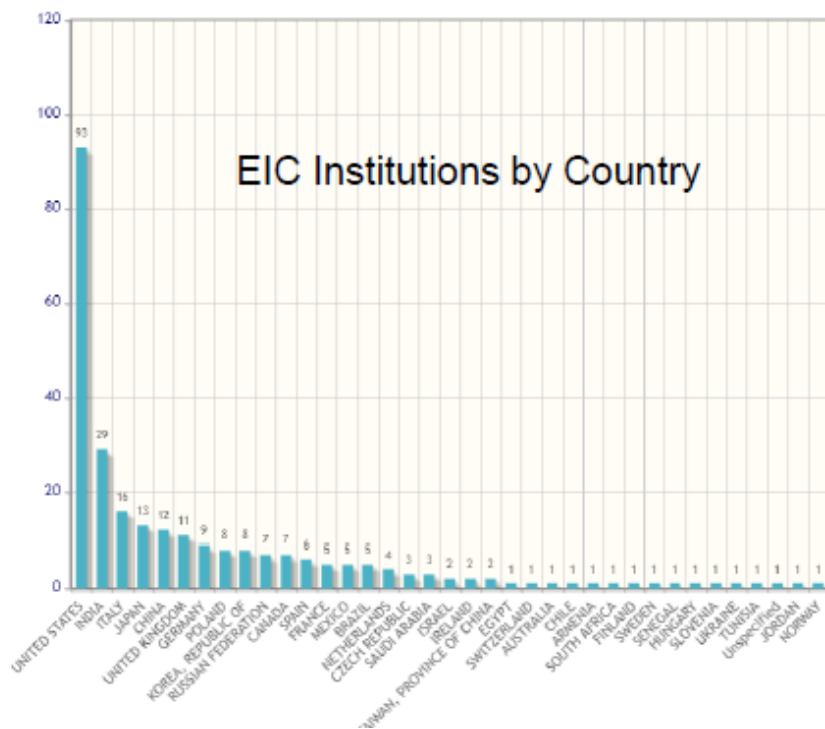
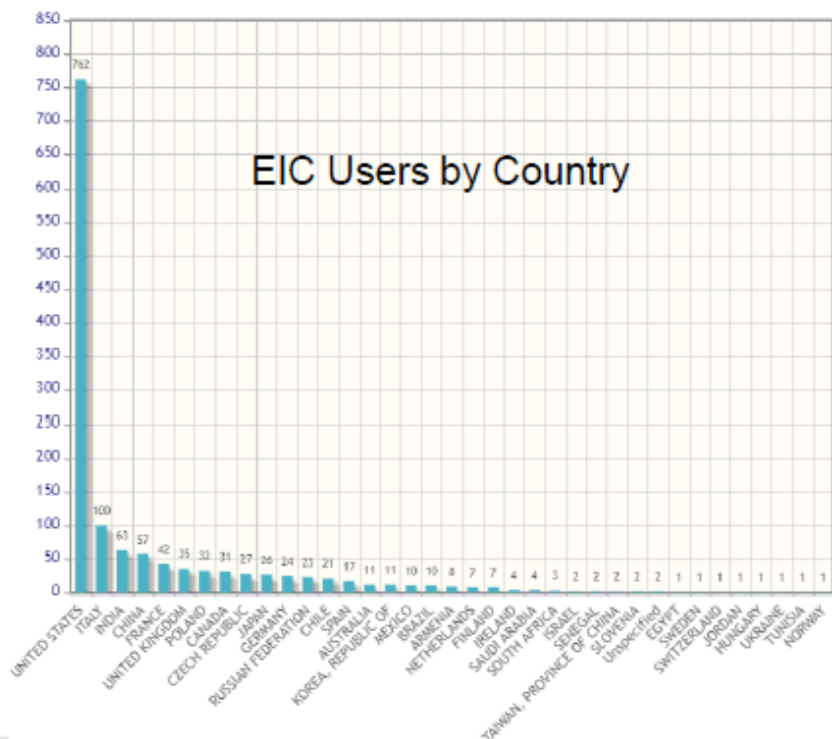
September 28, 2022

6

The EIC User Community On The Move

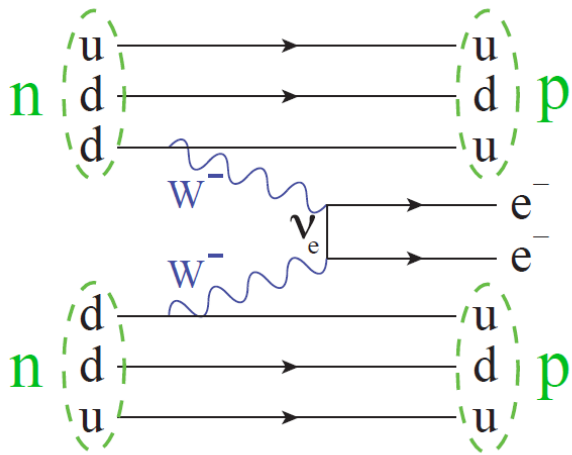
The EIC User Group

There are now >1350 EIC Highly Active Users from 267 Institutions in 36 countries



The Global Campaign to Determine the Fundamental Nature of the Neutrino

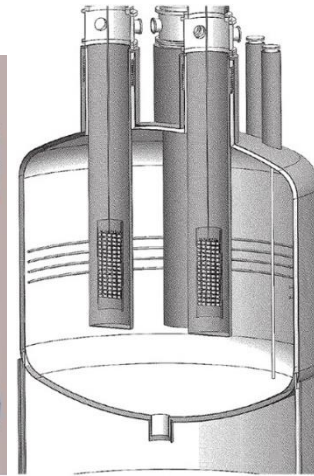
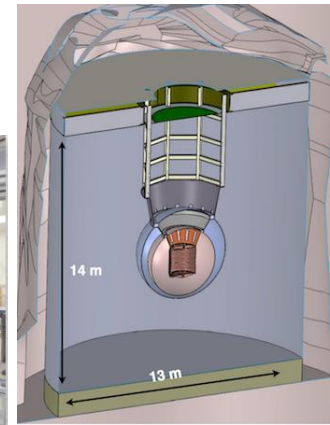
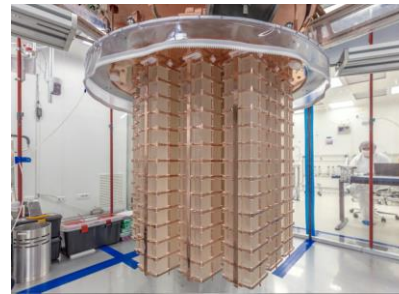
The Search for Neutrino-less Double Beta Decay ($0\nu\beta\beta$): in a selected nucleus, two neutrons decay into two protons and two electrons, with no neutrinos being emitted.



It required the two neutrinos from the two W^- particles to annihilate, proving the neutrino is its own anti-particle

Three Proposed Technologies

- Scintillating bolometry (**CUPID**, ^{100}Mo enriched Li_2Mo_4 crystals)
- Enriched ^{76}Ge crystals (**LEGEND-1000**, drifted charge, point contact detectors)
- Liquid Xenon TPC (**nEXO**, light via SiPM, drifted ionization)



Potential Partners: Italy, Canada, and Germany

Diversity, Equity, and Inclusion:

The rollout of a major new thrust, underscoring that we all have an important role to play in enhancing DEI will take place next Monday.



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