Report from the NSF

Jim Thomas
Program Director for Nuclear Physics

June 22nd, 2020

The NSF is functioning normally (almost) …

- A new Director for the National Science Foundation
  - Sethuraman Panchanathan
    - Executive Vice President at Arizona State University
    - Professor of Computer Science and Engineering
    - Affectionately known as “Panch”
  - Confirmed by House and Senate on Thursday
    - Nominated to the National Science Board by President Obama in 2014
    - Nominated by President Trump to head the NSF on December 18th
    - NSF Directors serve for 6 years
- The outgoing Director is France A. Cordova
  - We were unable to giver her an in-person send off due to the Pandemic
  - The acting Director in the interlude has been Kevin Droegemeier … thank you
- Other important Sr. management changes
  - Ann Kinney: Assistant Director for Mathematical and Physical Sciences ⇒ NASA
  - Sean Jones is the acting Assistant Director for MPS

Wow – what a year …

- The National Science Foundation Building has been closed since March 23rd
- Like our professional society meetings, NSF Panels and other reviews have been conducted virtually since that time
  - Travel has been suspended for the foreseeable future
  - We reported to our administration that we are 100% efficient and they responded "Oh, so there is no hurry to re-open the building". Sigh.
- Thank you! to everyone who has participated in an NSF review under these unusual circumstances
  - We may be in this mode for a while
  - Comments and thoughts are welcome ☺
- NSF Response to the crisis
  - Administrative relief, allowability of costs, due date extensions … are possible
  - Repurposing of Federal assistance awards to support COVID-19
  - RAPID proposals to conduct non-medical research to support the COVID response

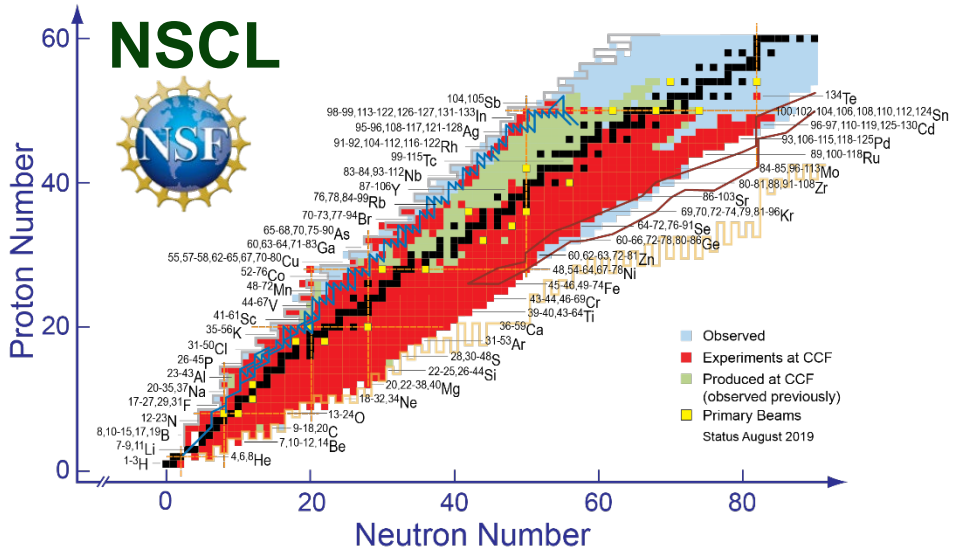
    717 awards have been made for research on COVID-19

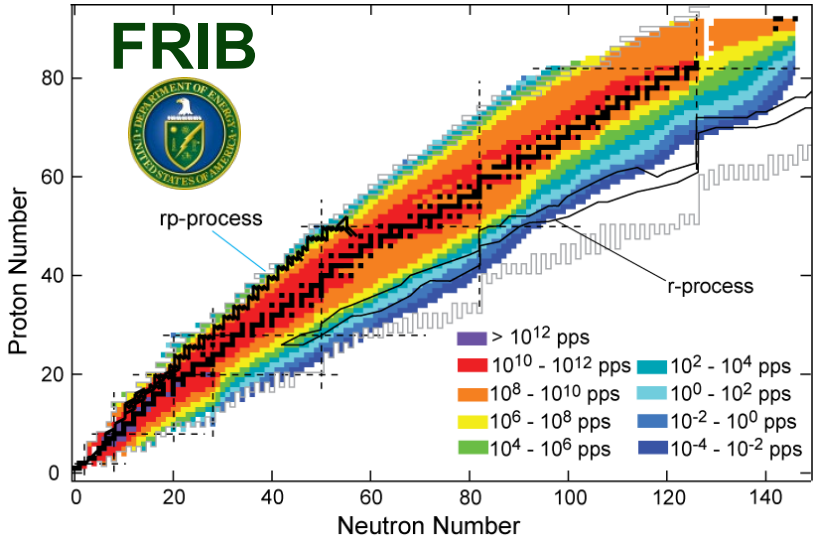
The scientific community is (slowly) opening up around the world

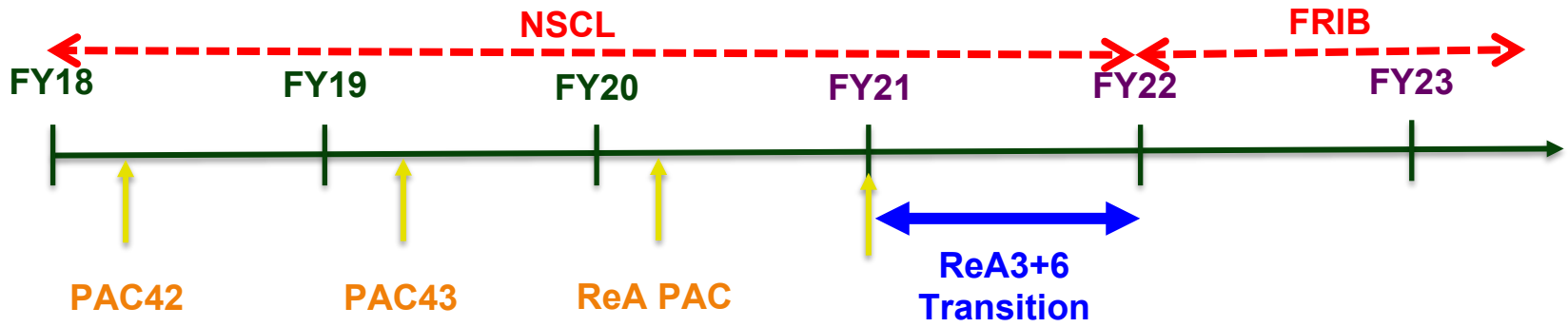
- The US Labs and User Facilities are opening up
  - Jefferson Lab is in limited on-site operations for select staff and Users
  - RHIC beams are up and running and staffed by essential personnel (Long Island)
- Paul Scherrer institute is accessible to essential personnel (Swiss)
- Grand Sasso is accessible to essential personnel (mostly Italian)
- The National Superconducting Cyclotron Laboratory (NSCL) at MSU is open to essential personnel under strict guidelines
  - NSCL suspended user operations on March 23rd
  - User program resumed on May 29th under very special circumstances
    - Users must reside in Michigan, PPE, self distancing, etc.
    - First experiments resumed mid-June
  - Construction activities are allowed to resume
    - SECAR and ReA6 projects underway with essential personnel
  - They are incurring extraordinary expenses … the University and the NSF are attempting to help
  - NSCL and other labs are not expecting to recover all of the lost beamtime

NSCL/FRIB Transition

Smooth & close coordination ⇒ Exciting opportunities







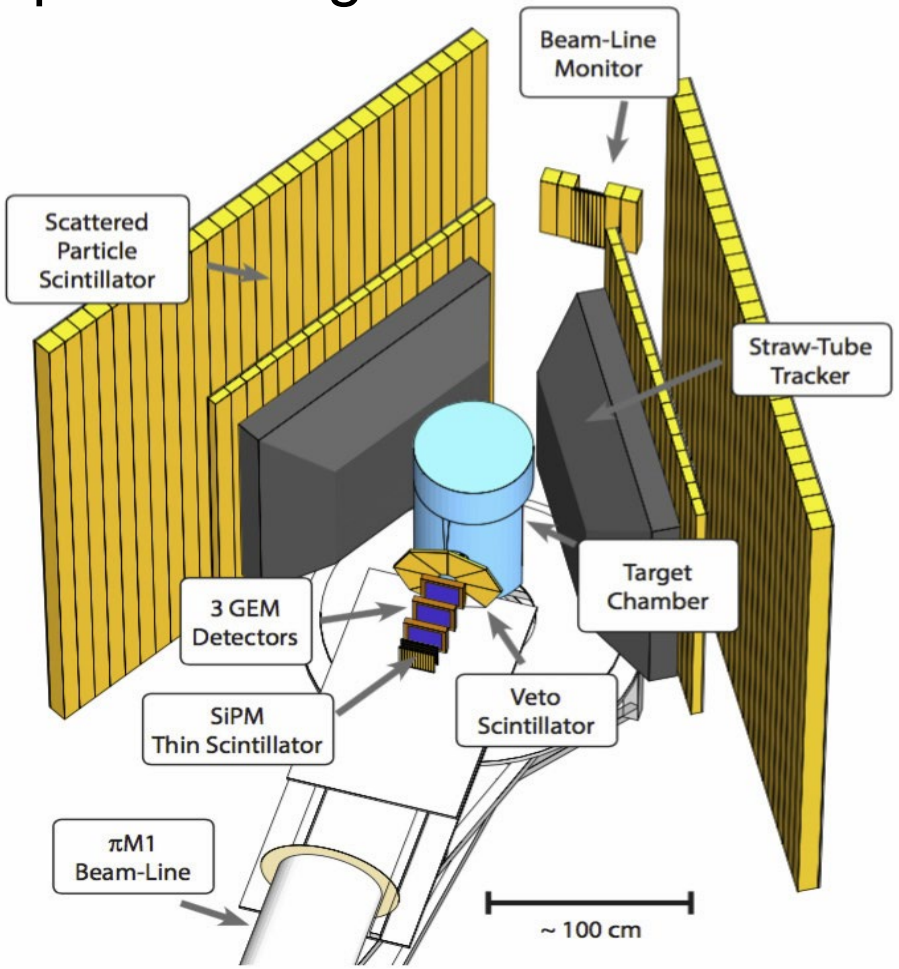
ReA PAC considered 31 proposals (5610 hours) approved 13 proposals (3199 hours) and then COVID pandemic hit … actual run schedule is a work in progress

MUSE @ PSI

Proton Radius Problem: Atomic measurement of μ-H → p radius was (until recently) 7σ smaller than e-H and e-p scattering

Precise comparison of e-p and μ-p scattering

- Data taking: 20 weeks in CY 20 & 21
- Goal: σ for elastic scattering of $\mu^{+/-}$ and $e^{+/-}$ with sub sub-1% relative precision over Q^2 from 0.002 to 0.07 GeV



PIs: R. Gilman (Rutgers), E. Downie (GWU), M. Kohl (Hampton), W. Lorenzon (U Mich), S. Strauch (USC)

"Super-Enge" Split-Pole Spectrograph at Florida State University

SPS moved from Yale to FSU Fall 2013

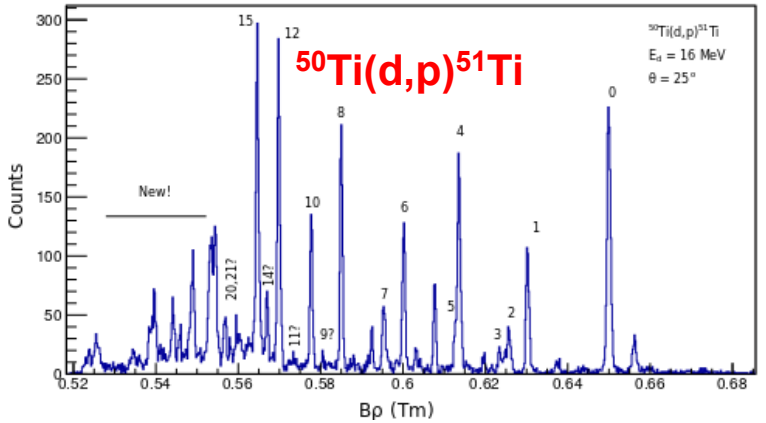
NSF MRI funding secured Summer 2014

Construction and installation 2015 – 2017

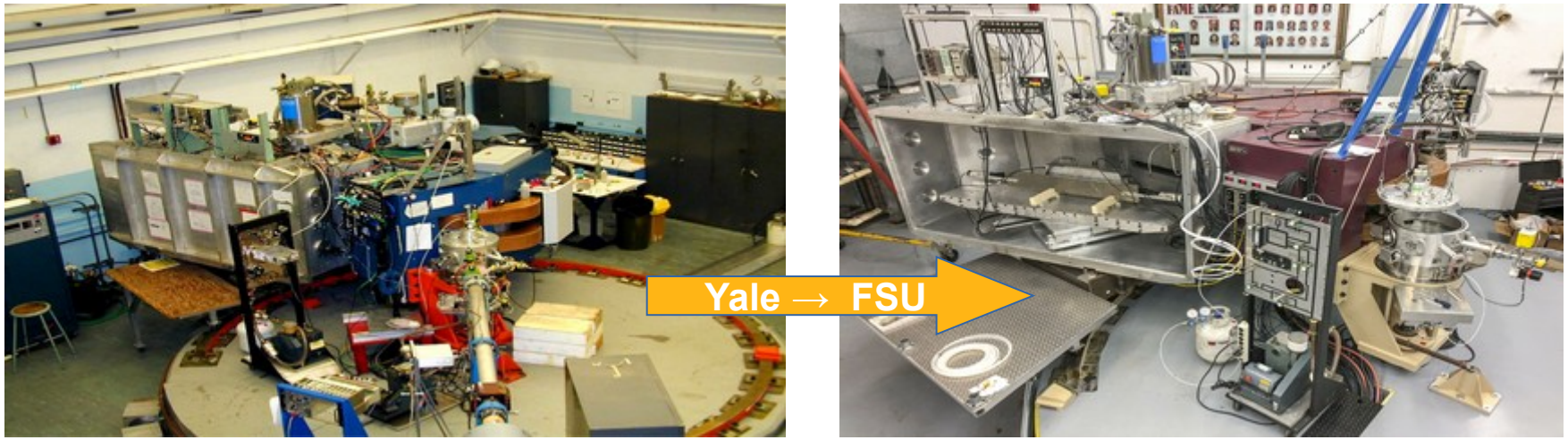
First beam on target, June 2018

20 keV resolution in (d,p) Summer 2019

Full scientific program Summer/Fall 2020



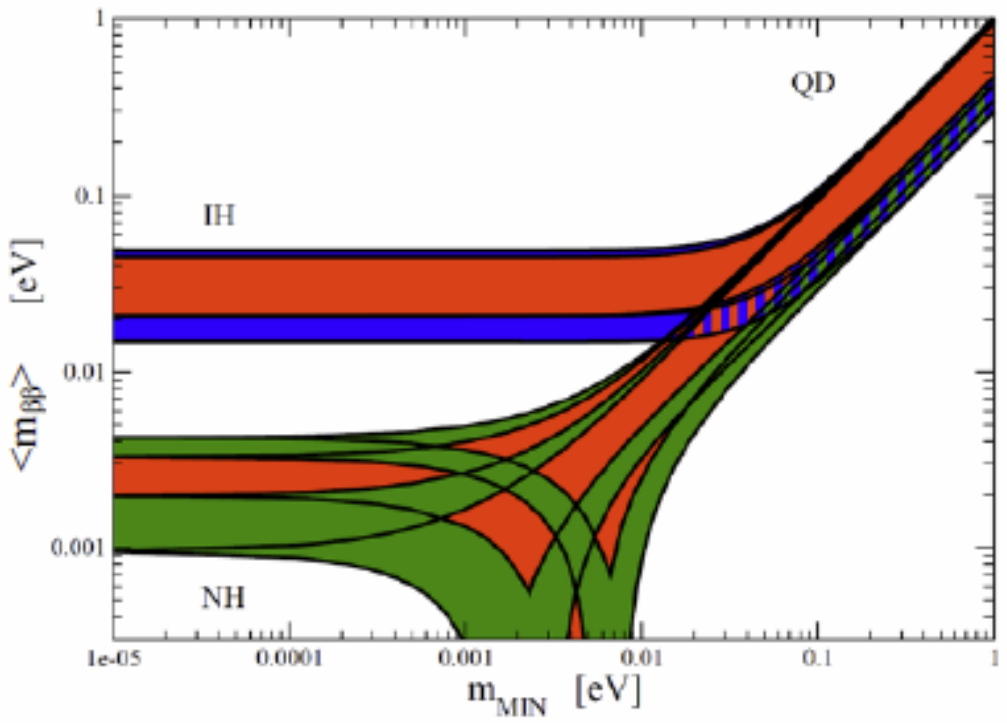
J. Nebel-Cresson, L. Riley (Urisinus College)
REU-Project, Summer 2019



LEGEND-200

^{76}Ge search for $0\nu\beta\beta$: MJD + GERDA + 135 kg enriched material

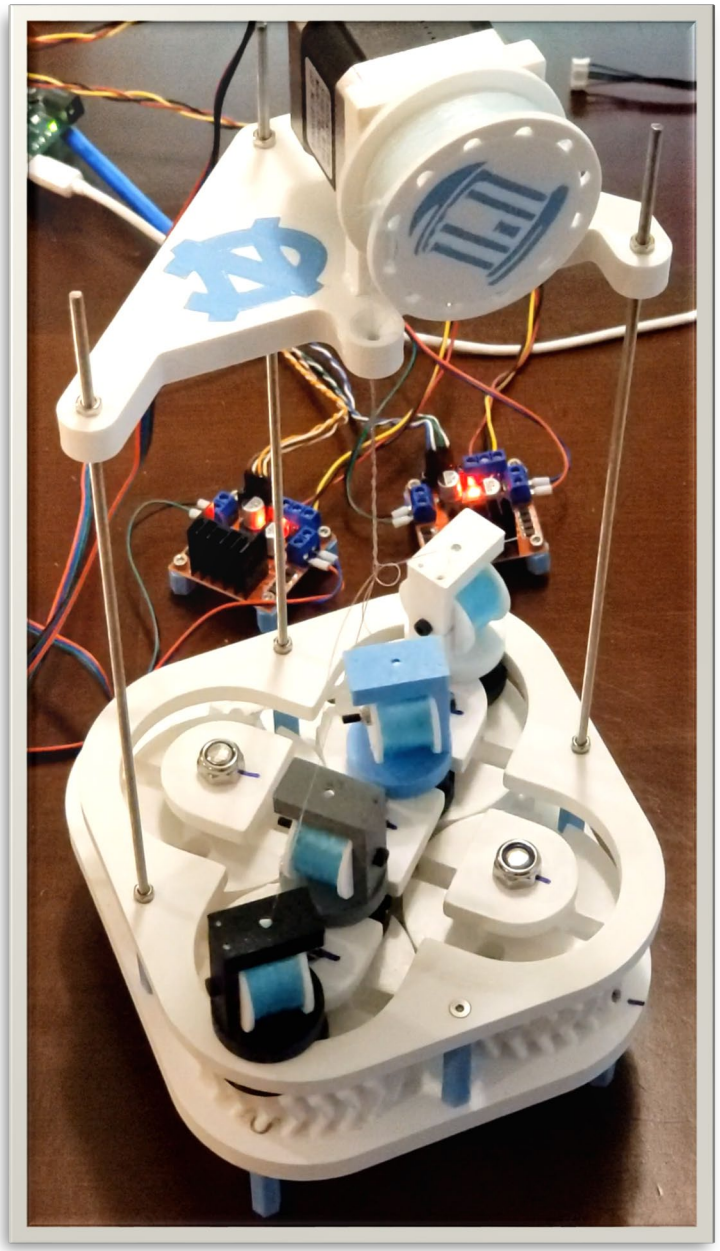
- 200 kg of enriched ^{76}Ge (>86%)
- Sensitivity goal: $T_{½} > 10^{27}$ yr
  - 5 year data taking planned
- $\langle m_{\beta\beta} \rangle \approx (35 – 75)$ meV
- Background reduction 5x req'd
  - Underground fabrication of components
  - Active muon shielding
    - Outer shield H_20, Inner shield LAr
- Located in Gran Sasso (LNGS)



Allowed values of $\langle m_{\beta\beta} \rangle$ as a function of the lightest ν mass.

PIs: J. Wilkerson (UNC) & S. Elliott (LANL)

Productivity during the COVID pandemic: Legend 200 @ UNC



- Scientists and engineers are very creative and it is impossible to stop us from being productive
  - We've seen electrical engineers with a complete set of IC design and diagnostic tools in their basement: based on a home computer and built on a personal budget
- Legend 200 needs 4 braided coaxial cables to readout each ^{76}Ge crystal in their $\beta\beta$ decay detector array
  - Eric Martin, a postdoctoral fellow at UNC, used a 3D printer to design, fabricate, and assembled the braiding machine from the safety of his home
  - Each cable is about the size of monofilament fishing line (as shown in this test)
  - This apparatus is clean, does not require lubrication, and will provide low mass – low noise cables for the experiment

The National Science Foundation

- The NSF responds to proposals from a broad community of experts
  - Extraordinary science from outstanding University groups + Laboratories
  - Extraordinary science from small Colleges
  - containing compelling Broader Impacts with societal impact
- Two review criteria
  - Intellectual Merit
  - Broader Impacts

  With no prescribed weight on either criteria
    - Education & Outreach
    - Building the economy & workforce of the future through STEM
    - Broadening participation
    - Impact on other fields of science & engineering
    - National Security … more
- Thank you to everyone who reviewed proposals and sat on (virtual) panels
  - The COVID-19 crisis is not over … but
  - You worked quickly & on short deadlines, greatly appreciated!

Funding opportunities

- Standard research grants
- CAREER Proposals - due July 27th, 2020
- MRIs, Physics MidScale, MsRI-1, MsRI-2, MREFC
  - Construction funds to build instrumentation and facilities
  - (limited resources for design … it is usually assumed that early R&D is supported by the base program)
- Opportunities to broaden diversity with co-funding available
  - AGEP
  - EPSCoR
  - HBCU

Standard Grants

- Investigator Initiated Research Projects NSF 20-580
- Deadline for Experimental Nuclear Physics and Nuclear Theory proposals
  - Due the first Tuesday in December ⇒ December 1st, 2020
  - Note: there is a new Physics solicitation NSF 20-580
    - https://www.nsf.gov/pubs/2020/nsf20580/nsf20580.htm
- The new solicitation also accepts proposals for Midscale Instrumentation
  - $4M - $15M
  - non-renewable one-time grant
  - Proposals solicited annually at the same time as the standard grants
  - Construction and/or Acquisition of Instrumentation
    - Early R&D is expected to be funded by the base program
- Collaborators and Other Affiliations Template
  - Please list 'conflicts of interest' … not everyone in your collaboration
- Read & review the instructions carefully because there is a lot of "fine print"

Faculty Early Career Development Program (CAREER)

- CAREER NSF 20-525
  - Awards in support of early-career faculty who have the potential to serve as academic role models in research and education
- PECASE
  - Presidential Early Career Awards for Scientists and Engineers from among the most meritorious recent CAREER awardees
- Selection for these awards is based on two important criteria:
  - Innovative research (IM)
  - Leadership in education (BI)
- Eligibility – Assistant Professor, untenured, etc.
  - Five year awards
  - Deadline: Third Friday in July ⇒ July 27, 2020
  - PECASE nominees are chose from within the pool of CAREER winners

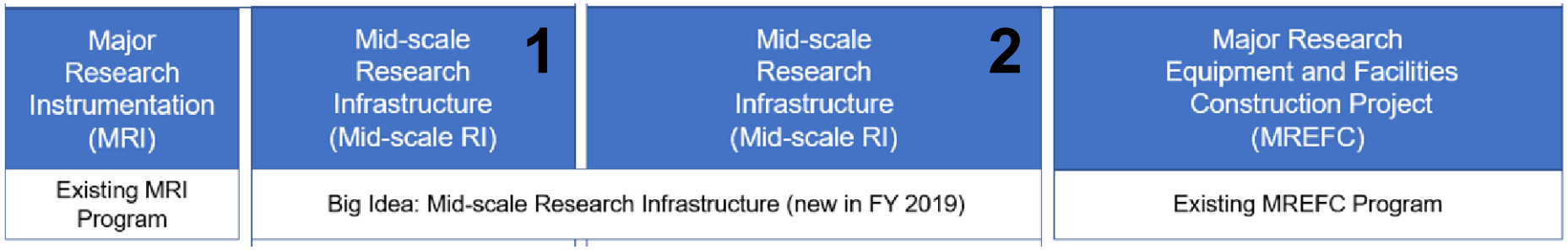
MRI – Major Research Instrumentation

- Two tracks: NSF 18-513
  - Track 1 $100 k < $ from NSF < $1 M; max of 2/university
  - Track 2 $1 M < $ from NSF < $4 M; max of 1/university
- Two types: development and acquisition
- Deadlines & details
  - January 1 – January 19, annually (a window of opportunity)
    - https://www.nsf.gov/od/oia/programs/mri/
    - https://www.nsf.gov/pubs/2018/nsf18513/nsf18513.htm
  - contact your program directors well ahead of time to discuss & avoid pitfalls
- Maximum award is $4M
  - 30% cost share req'd for PhD granting institutions
  - Awards above $1M compete across the entire Foundation

Mid-Scale Instrumentation

- Midscale Research Infrastructure-1 (MsRI-1) … active for FY2021!
  - $6M - $20M ~~NSF 19-537~~ To be UPDATED soon
  - Proposals solicited every other year Preproposals due in the Fall
  - Two types: Implementation & Design Invitation only for full proposals
    - Implementation proposals are usually "shovel ready" projects
    - Design proposals may request as little as $600k

- Midscale Research Infrastructure-2 (MsRI-2) … active for FY2021!
  - $20M - $70M ~~NSF 19-542~~ To be UPDATED soon
  - Proposals solicited every other year Letter of intent due in the Fall
  - "Shovel ready" projects, only Invitation only for full proposals



A word to the wise …

- If you choose to compete for an MRI, MSRI-1, MSRI-2 or MREFC
  - Be ready to compete against LIGO and the Event Horizon Telescope!

IT at the NSF

- Many people have suggested that we change the system but despite the inertia, there are a few changes coming …
- 'Fastlane' and Research.gov are the preferred ways to submit proposals to the NSF
  - The basic character set has been updated
  - Far fewer "?" in your written reviews & text
- Artificial Intelligence is being used to a greater and greater degree to process AI proposals
  - Pioneered by Comp. Info. Science & Eng. (CISE)
  - New templates for 'bio-sketches' and 'pending support' pages to better allow machine scanning
  - Proposal & Award Policies & Procedures Guide (PAPPG) updated with these template changes
    - https://www.nsf.gov/pubs/policydocs/pappg20_1/index.jsp

Saleeva Atisanoe – "Konishiki" and a young friend at the 1993 San Jose, CA Sumo Exhibition

This means we now have AI funding AI

NSF Nuclear Physics – Budget Trends

Includes co-funding and other leveraged funds

FY	Nucleon & Hadron QCD (k$)	Nuclear Astroph, Reactions, Structure (k$)	Prec Meas'ts & Fund. Symm. (k$)	Total Exp't Nuclear Physics (k$)	Nuclear Theory (k$)	Nuclear Program Total (k$)	NSCL (k$)	JINA & JINA -CEE (k$)	MRI (K$)	Mid-Scale (K$)	Total Nuclear Physics (k$)
2016	7,141	5,046	7,391	19,579	4,223	23,802	24,000	2,280	1,869	3,238	55,189
2017	6,955	6,273	6,692	19,920	4,344	24,264	24,000	2,280	530	2,990	54,064
2018	7,160	5,048	7,589	19,787	4,384	24,171	24,000	2,280	3,970	5,249	59,791
2019	6,325	7,322	6,884	20,531	4,321	24,851	28,500	2,280	3,549	5,806	64,986

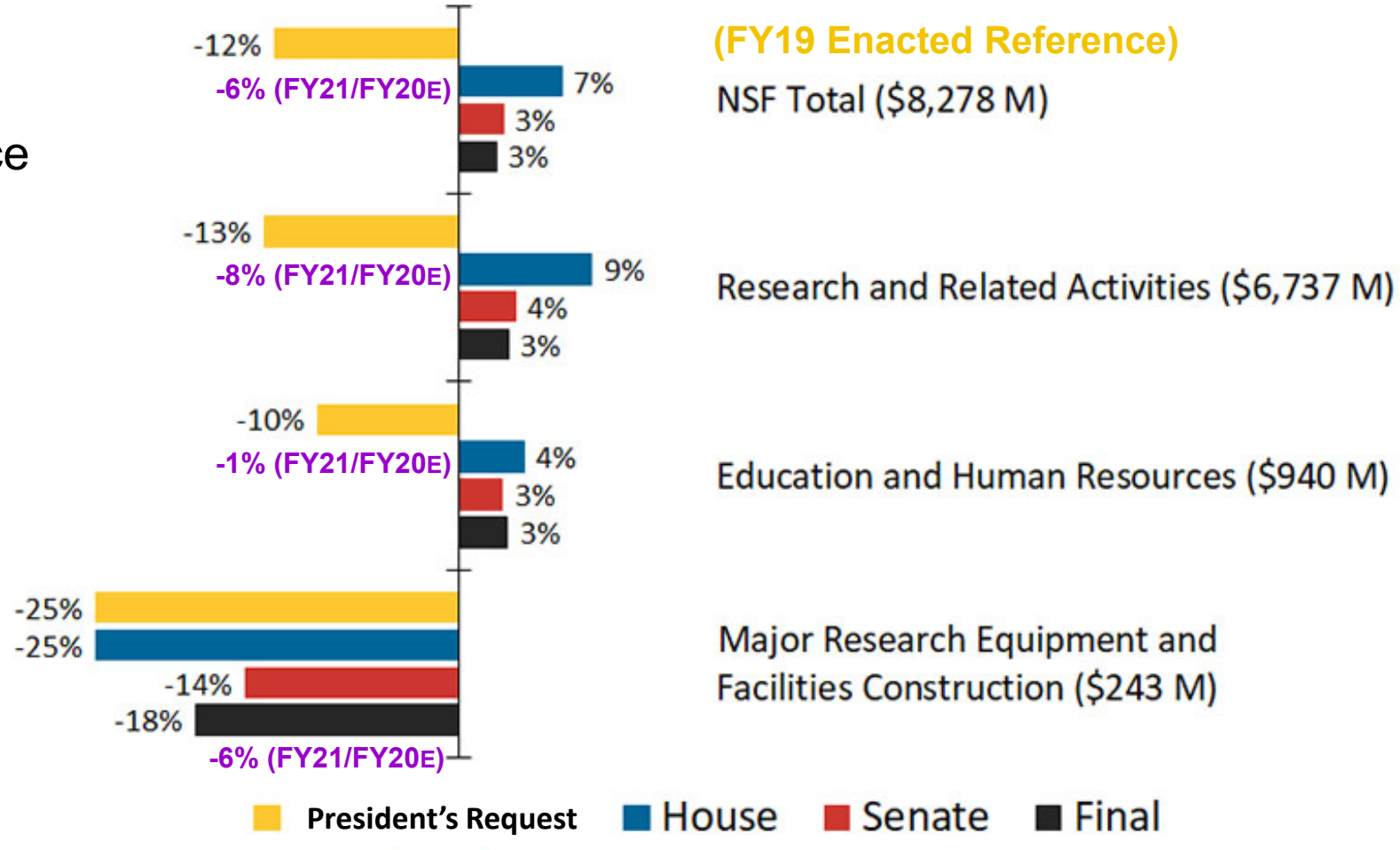
Flat

~ 25% = Research
~ 75% = Operations

FY19 NSCL $28.5M = $24M + $4.5M to forward fund ¼ FY21 M&O
MRI: competes each year; one-time acquisition/development funds
Mid-scale: ad hoc competition; design and construction funds (L-200, MUSE, nEDM)

FY20 NSF Budget Appropriations and the FY21 Request

- The President's office makes a low bid
- The House and Senate respond
- Then we have to be patient to see what develops

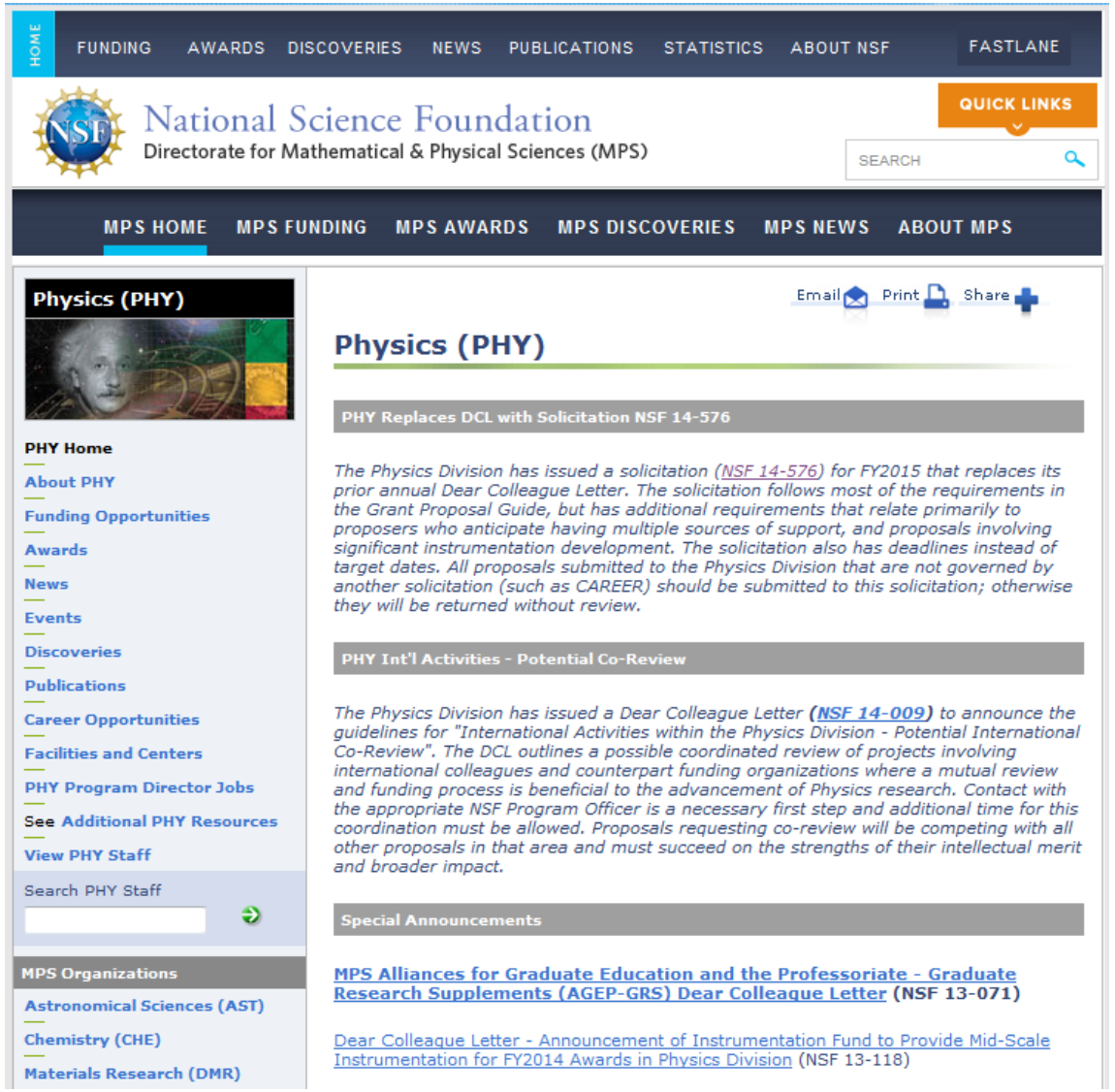


Parting words …

- Do good science
- Be mindful of your implicit biases
- Broaden participation … make an impact on society!
  - Education and outreach
  - When possible, open your lab to the community for tours
  - Talk to the 10 year old who lives next door
- Acknowledge your funding agencies in your publications and talks

More information

- News & updates
  - https://www.nsf.gov/physics
- Contact us:
  - bmihaila@nsf.gov
    (703) 292-8235
  - aopper@nsf.gov
    (703) 292-8958
  - jhthomas@nsf.gov
    (703) 292-2911



Backup Slides

Users Organization Meeting
Jefferson Lab 2020

Jim Thomas

NSF Technology Directorate (?)

Lawmakers have proposed adding a technology wing to the NSF

- Senate Minority Leader Chuck Schumer (D-NY) and Sen. Todd Young (R-IN) introduced legislation on May 21 titled the Endless Frontier Act, which would re-designate the National Science Foundation as the National Science and Technology Foundation and create a new Directorate of Technology within the agency. The new directorate's efforts would concentrate on […]
  - artificial intelligence and machine learning
  - high performance computing, semiconductors, and advanced computer hardware
  - quantum computing and information systems
  - robotics, automation, and advanced manufacturing
  - natural or anthropogenic disaster prevention
  - advanced communications technology
  - biotechnology, genomics, and synthetic biology
  - cybersecurity, data storage, and data management technologies
  - advanced energy
  - materials science, engineering, and exploration relevant to the other key technology focus areas
- The bill recommends the directorate's budget rise from $2 billion in FY 2021 to $35 billion in fiscal years 2024 and 2025, with a "hold harmless" provision mandating it cannot receive any funds in a given fiscal year if the budget for the rest of NSF declines. NSF's annual budget is currently about $8 billion. Schumer and Young's bill would also establish a Regional Technology Hub Program administered by the U.S. Economic Development Administration and NIST […]

source: https://www.aip.org/fyi

NSF Response to COVID-19

- NSF has been operating via telework since ~ mid-March
  - All panels have been virtual since that date.
- Repurposing of Federal assistance awards to support COVID-19
  - NSF Implementation of OMB Memorandum M-20-20
- Administrative relief, allowability of costs, due date extensions, …
  - NSF Implementation of OMB Memorandum M-20-17
- NSF FAQ pages
- RAPID proposals to conduct non-medical, non-clinical-care research that can be used immediately to explore how to model and understand the spread of COVID-19, to inform and educate about the science of virus transmission and prevention, and to encourage the development of processes and actions to address this global challenge.
  - Dear Colleague Letter on the Coronavirus Disease 2019 (COVID-19)
  - 97 awards have been made, so far

The 10 Big Ideas in the FY2021 request

RESEARCH IDEAS

$45M →

Harnessing Data for 21st Century Science and Engineering

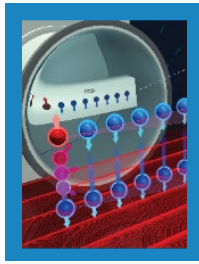
Work at the Human-Technology Frontier: Shaping the Future

Navigating the New Arctic

$30M ↓

Windows on the Universe: The Era of Multi-messenger Astrophysics

The Quantum Leap: Leading the Next Quantum Revolution



← $50M

Understanding the Rules of Life: Predicting Phenotype

PROCESS IDEAS

$98M →

Mid-scale Research Infrastructure

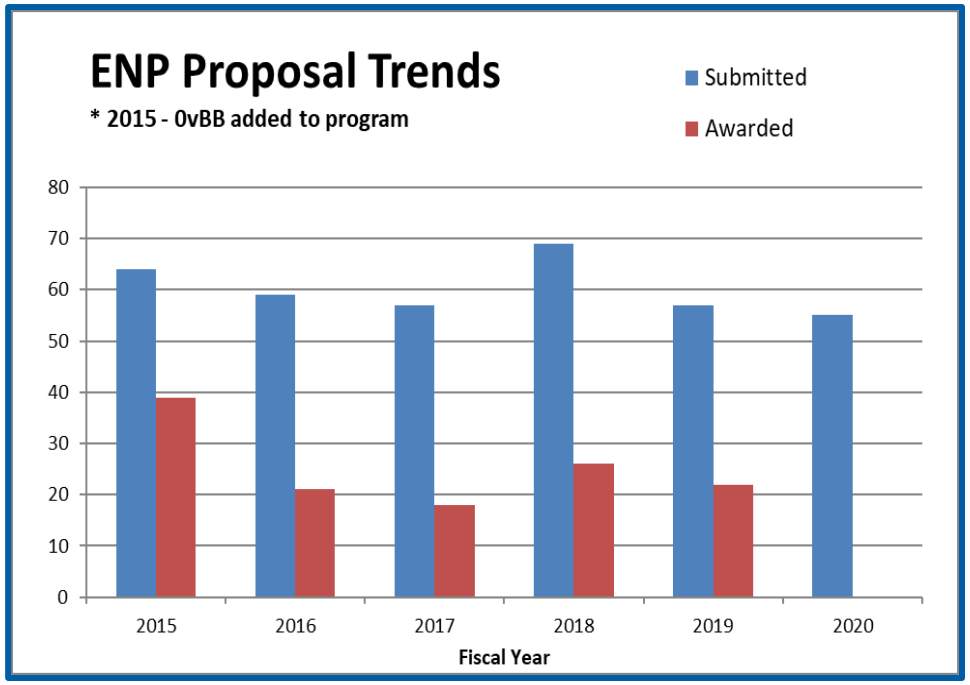
NSF 2026

Growing Convergence Research at NSF

NSF INCLUDES: Enhancing STEM through Diversity and Inclusion

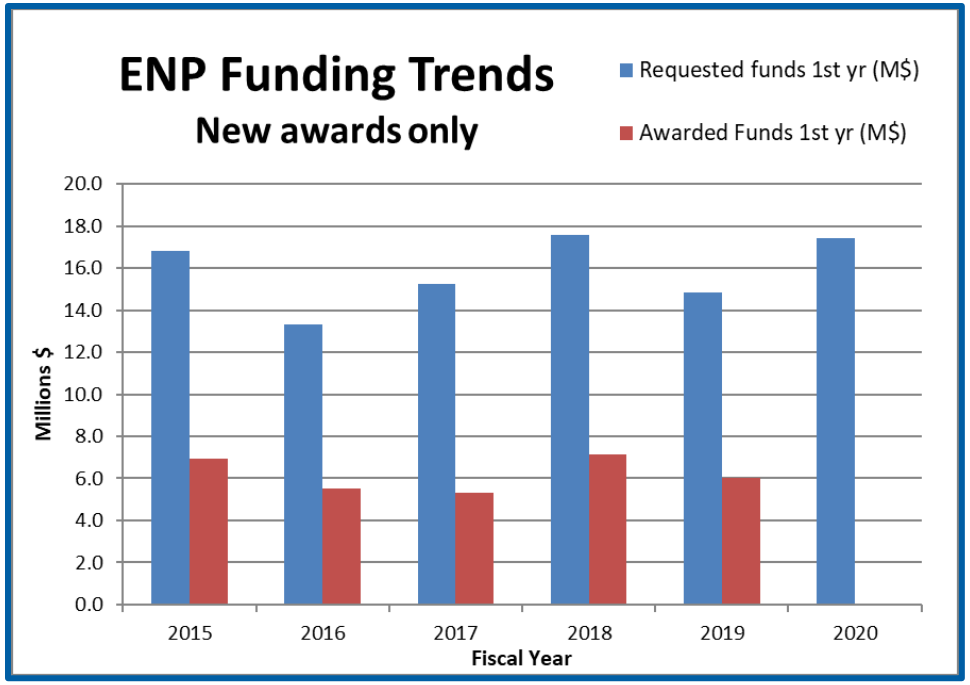
Each Big Idea has a dedicated solicitation except for WoU which is a Standard Grant application where WoU-MMA is included in the title

Trends in Experimental Nuclear Physics



Proposal pressure

Funding pressure



Physics Funding within the NSF – The Presidents Request

PHY Funding
(Dollars in Millions)

	FY 2019 Actual	FY 2020 (TBD)	FY 2021 Request	Change over FY 2019 Actual Amount	Change over FY 2019 Actual Percent
Total	**$285.23**	**-**	**$257.83**	**-$27.40**	**-9.6%**
Research	**163.37**	**-**	**162.81**	**-0.56**	**-0.3%**
Centers Funding (total)	4.74	-	5.00	0.26	5.5%
STC: Center for Bright Beams	*4.74*	-	*5.00*	*0.26*	*5.5%*
Education	**5.52**	**-**	**4.56**	**-0.96**	**-17.5%**
Infrastructure	**116.33**	**-**	**90.46**	**-25.87**	**-22.2%**
IceCube	3.50	-	3.50	-	-
LHC	16.00	-	20.00	4.00	25.0%
LIGO[1]	55.47	-	45.00	-10.47	-18.9%
Midscale Research Infrastructure	13.34	-	6.46	-6.88	-51.6%
NSCL[2]	28.00	-	15.50	-12.50	-44.6%
Research Resources	0.02	-	-	-0.02	-100.0%

Physics is slightly more negative than the overall NSF request … but the devil is in the details and it is not clear how the COVID-19 pandemic will affect the House and Senate markups

Alliances for Graduate Education and the Professorate (AGEP)

- AGEP GR supplements to MPS awards NSF 20-083 and 16-552
- A mechanism by which a current MPS research awardee is able to support one (additional) Ph.D. student in an ongoing MPS-funded research project. The goal is […] to improve diversity and retention at the doctoral level within the mathematical and physical sciences.
- Available to PIs at AGEP or AGEP Legacy Institutions
  - https://www.nsf.gov/mps/broadening_participation/index.jsp
- Graduate Student Eligibility
  - Emphasis placed on under-represented groups in STEM fields
  - Not currently supported by federal government (NSF, DOE, NIH, …)
  - US Citizen, US National, or US Permanent Resident
  - Stipend, tuition, benefits, and IDC (~$60k)
- Renewable up to two times, no deadline for submission

Writing proposals: Mentoring program

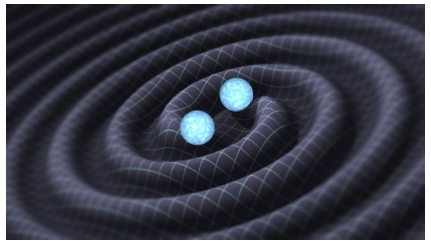
- GOAL: To make the proposal writing expertise of senior researchers available to junior investigators
- How does it work?
  - The Mentee requests a Mentor
    - email us at aopper@nsf.gov or jhthomas@nsf.gov
  - We will send a list of Mentor Volunteers to Mentee
  - Mentee contacts Mentors without identifying themselves to NSF
  - The Mentor will read the Mentee's proposal and provide feedback - once
    - Send the proposal early – Mentors are busy people!
  - NSF accepts no responsibility on the interaction/outcome of the program
- Mentors needed: please volunteer
  - email us at aopper@nsf.gov or jhthomas@nsf.gov

Money – where does it come from, where does it go?

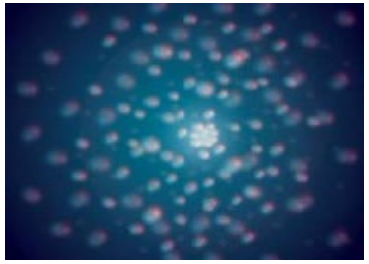
- The NSF is a little different than other agencies of the government
  - Congress makes appropriations for the NSF budget with respect to six broad categories … rather than line by line
  - So developing the NSF's final 'operating plan' requires an extra step
- The President's office prepares a budget in consultation with the NSF and the Office of Management and Budget
- Congress passes an appropriation for the NSF
  - Often with additional instructions and not always the same as the Presidents request
  - The president signs the appropriations bill
- The NSF proposes an operating plan based on the final budget and submits it to Congress via OMB
- Congress approves the operating plan

Physics Division – within Mathematical and Physical Sciences

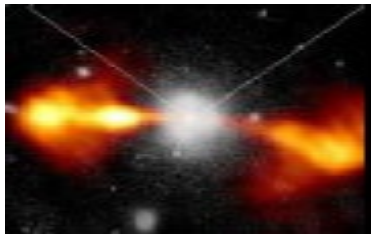
Nucleosynthesis in accreting white dwarfs at JINA



Black hole – Black hole mergers observed in LIGO



Ultracold Molecules at JILA

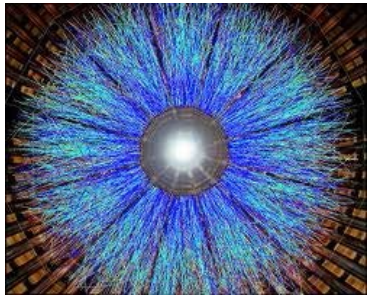


Broadening Participation In STEM

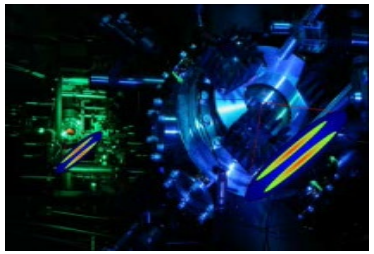
Active Galactic Nuclei produce HE cosmic rays in Pierre Auger Observatory

Nuclear Astrophysics (and much more) at NSCL

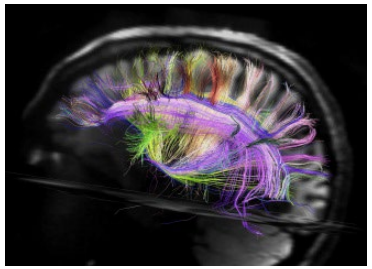
Heavy Ion collisions at RHIC



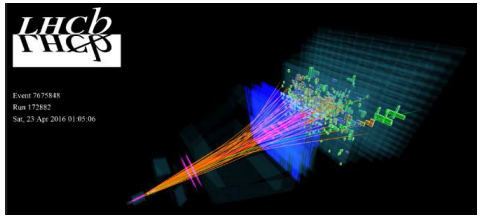
Quantum Networks at Caltech



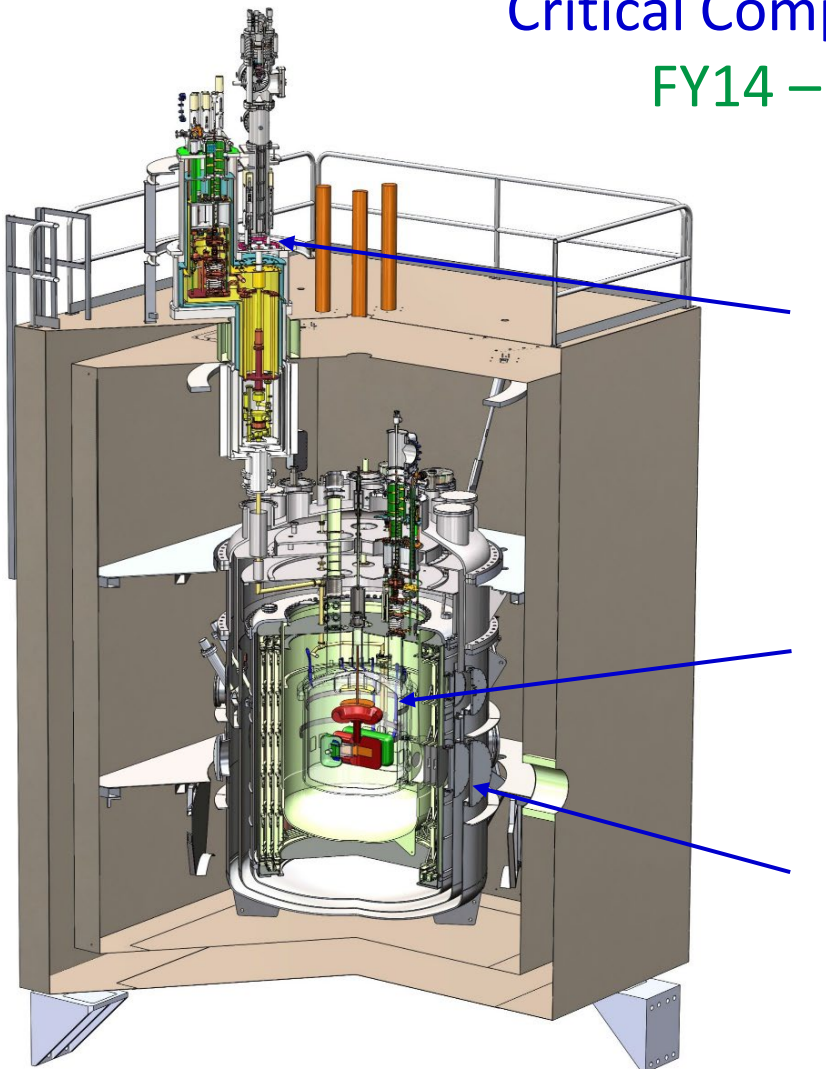
Brain Wave Images with diffusion MRI



LHCb at CERN – tetraquarks, pentaquarks



Physics Midscale example: nEDM @ SNS



Critical Component Design → Large Subsystem Integration

FY14 – FY17: $5.2 M

FY18 – FY22: $7.7 M

- Prepare polarized ^{3}He
- Isotopically purify ^{4}He; each measurement cycle
- Generate electric field
- Store ^{3}He & neutrons
- Monitor ^{3}He & neutron precession frequencies
- Generate uniform B-field

PI's: Brad Fillippone (Caltech) & Doug Beck (UIUC)

New measures to protect research community from harassment

- Terms and conditions for NSF grants have been amended as of October 2018
  - The threshold for reporting Harassment and related situations has changed to include administrative actions
    - Finding and determinations $\Rightarrow$ Administrative actions

- NSF is concerned about the Safety and security of personnel supported by an NSF award
  - Time to make a “Finding or Determination” may leave NSF supported personnel in a vulnerable position
  - The NSF will consult with the awardee organization, and determine what action is necessary under NSF's authority (such as substituting or removing the PI)

- NSF supported conferences must have a harassment policy and code of conduct that addresses sexual harassment

New measures to protect research community from harassment

- News Release 18-082: September 19, 2018 Effective October 22, 2018
- New term and condition "Notification Requirements Regarding Findings of Sexual Harassment, Other Forms of Harassment, or Sexual Assault" requires awardee organizations to notify NSF of:
  - Any findings or determinations that an NSF-funded principal investigator or co-principal investigator committed harassment, including sexual harassment or sexual assault.
  - The placement of the principal investigator or co-principal investigator on administrative leave, or of the imposition of any administrative action relating to a harassment or sexual assault finding or investigation.
- NSF will consult with the awardee organization, and determine what action is necessary under NSF's authority.
  - NSF actions may include substituting or removing principal investigators or co-principal investigators, reducing award funding, and – where neither of those options is available or adequate – suspending or terminating awards.