

NSF Nuclear Physics Overview



Allena K. Opper & Bogdan Mihaila

- New personnel
- Budget – focus on PHY
- Announcements



NSF/MPS/Physics Personnel

- **France Córdova** – Director
- **Anne L Kinney** – Assistant Director for MPS
- **Denise Caldwell** – Physics Division Director
- ★ **Jean Cottam Allen** – Acting Deputy Division Director
- **Bogdan Mihaila** – Nuclear Theory Program Director
- ★ **Jim Thomas** – Expt'l Nuclear Physics Program Director
- **Allena Oppen** – Expt'l Nuclear Physics Program Director

<http://www.nsf.gov/pubs/2015/phy15001/phy15001.jsp?org=PHY>

<http://www.nsf.gov/careers/rotator/index.jsp>



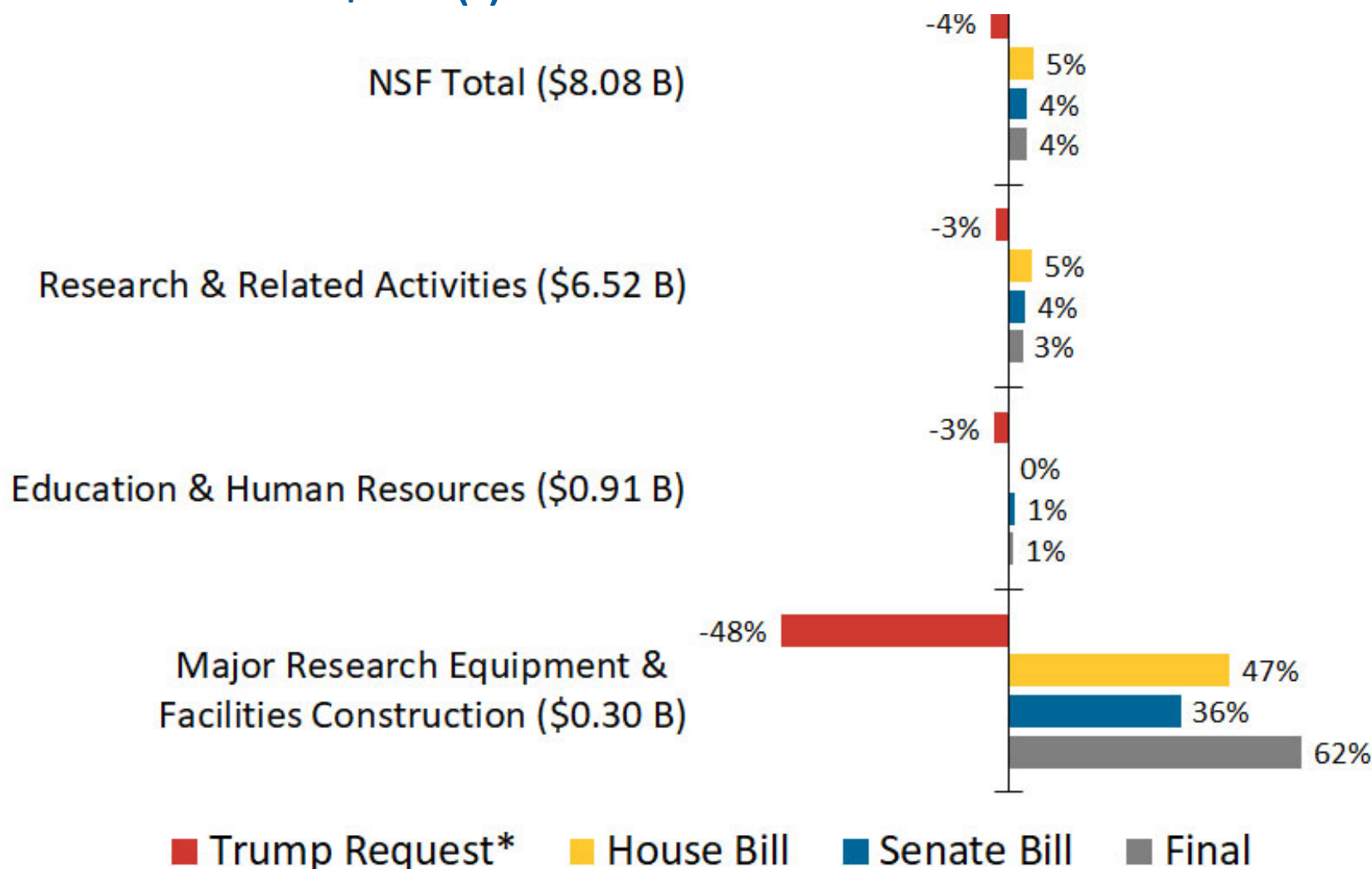
Interesting Times

- Launched Mid-scale Research Infrastructure -1 (\$6M - \$20M) 21-nov-2018
- Launched Mid-scale Research Infrastructure -2 (\$20M - \$70M) 11-dec-2018
- Lapse in Appropriations:
 - 22-dec-2018 → 25-jan-2019
 - NSF staff not allowed to work even on voluntary basis
 - IPA Rotators (and other essential personnel) ran NSF
 - MRI proposal due date 22-jan-2019
- Onward from January 28th
 - Thank you to reviewers and panelists providing service during compressed review cycle



NSF FY19 Appropriations

% change from FY18 enacted
\$ in () = FY19 amounts



* The administration submitted the budget request to Congress before the final amounts for fiscal year 2018 were set.

FY19 & FY20 Budget Process



- Agency budget request → OMB ~ end of summer
- “Pass Back”: OMB provides numbers to agency ~ end of Nov
 - May also include additional instructions
- President’s Budget Request set ~ end of cal year
 - Much activity → NSF Budget Book
- ...

FY20 ✓

FY20 ✓

FY20:
11-mar-2020

FY19:
25-jan-2019

- Congress passes appropriation ~ before beginning of FY
 - NSF: Amounts for 6 high-level accounts, occasionally with additional text
- President signs appropriation; budget → agency via OMB
- NSF generates a new Budget Book (“current plan”) and submits to Congress via OMB
- Congress acts within 30 days: “current plan” → “operating plan”

~ 60 days

FY20 PHY \$247.50M



(Dollars in Millions)

	FY 2018 Actual	FY 2019 (TBD)	FY 2020 Request	Change over FY 2018 Actual Amount	Percent
Total	\$310.75	-	\$247.50	-\$63.25	-20.4%
Research	182.35	-	145.63	-36.72	-20.1%
CAREER	10.14	-	6.78	-3.36	-33.1%
Centers Funding (total)	4.81	-	5.00	0.19	4.0%
STC: Center for Bright Beams	4.81	-	5.00	0.19	4.0%
Education	4.50	-	4.70	0.20	4.4%
Infrastructure	123.90	-	97.17	-26.73	-21.6%
IceCube	3.50	-	3.50	-	-
LHC	15.86	-	20.00	4.14	26.1%
LIGO	39.43	-	44.60	5.17	13.1%
Midscale Research Infrastructure	14.42	-	6.67	-7.75	-53.7%
NSCL	24.00	-	22.00	-2.00	-8.3%
Research Resources	0.09	-	-	-0.09	-100.0%
Facilities Design Stage Activities (total)	26.60	-	0.40	-26.20	-98.5%
High Luminosity-LHC ¹	16.60	-	-	-16.60	-100.0%
Advanced LIGO Plus (LIGO A+)	10.00	-	0.40	-9.60	-96.0%

¹ FY 2018 Actual reflects \$7.50 million of funding for FY 2019 and FY 2020 development and design. No additional funds are expected in these years.

Budget Trends – NSF Nuclear Physics



Includes co-funding and other leveraged funds

~ 25% = Research

~ 75% = Operations

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\$)
2012	7,969	4,185	6,343	18,497	3,829	22,326	21,500	2,150	2,744		48,720
2013	6,183	4,693	5,653	16,509	3,474	20,008	21,500	2,150	2,996	490	47,144
2014	5,826	5,189	5,999	17,014	3,514	20,528	22,500	2,280	1,038	1,188	47,533
2015	6,769	4,702	7,304	18,774	4,183	22,957	23,000	2,280	1,801	1,367	51,406
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	5,058	7,700	19,908 base = 17,800	4,384 base = 3,920	24,291	24,000	2,280	3,970	5,249	59,791

FY15 Fundamental Symmetries: + \$1.32M for $0\nu\beta\beta$

MRI: competes each year; one-time acquisition/development funds

Mid-scale: ad hoc competition; design and construction funds (L-200, MUSE, nEDM)

NSF's Big Ideas for Future Investments



- *Bold questions that will drive NSF's long-term research agenda*
- *Catalyze investment in fundamental research*
- *Collaborations with industry, private foundations, other agencies, universities*
- *Solve pressing problems and lead to new discoveries*



Career Program



- Solicitation: 17-537
- Must include excellent research proposal as well as excellent educational plan
- There are eligibility requirements: e.g., must be assistant professor, untenured
- 5 year awards, \$400,000 minimum
- Proposal deadline: **July 19, 2019 →**
PECASE nominees are chosen from CAREER winners
- Contact program officer for information/advice ahead of time (budget, scope)

Alliances for Graduate Education and the Professoriate (AGEP)



The AGEP program goal is to increase the number of historically underrepresented minority faculty, in specific STEM disciplines and STEM education research fields, by advancing knowledge about pathways to career success. **See NSF 16-662 for details.**

AGEP GR Supplements to MPS awards

- 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
 - *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

See us and DCL 16-125 for more information

For the latest updates, check out
<https://www.nsf.gov/div/index.jsp?div=PHY>



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The screenshot shows the NSF Directorate for Mathematical & Physical Sciences (MPS) website. The top navigation bar includes links for HOME, FUNDING, AWARDS, DISCOVERIES, NEWS, PUBLICATIONS, STATISTICS, ABOUT NSF, and FASTLANE. Below this is the NSF logo and the text "National Science Foundation Directorate for Mathematical & Physical Sciences (MPS)". A search bar and a "QUICK LINKS" button are also present. The main navigation bar for the MPS section includes links for MPS HOME, MPS FUNDING, MPS AWARDS, MPS DISCOVERIES, MPS NEWS, and ABOUT MPS. The "Physics (PHY)" section is highlighted. On the left, a sidebar lists various links: PHY Home, About PHY, Funding Opportunities, Awards, News, Events, Discoveries, Publications, Career Opportunities, Facilities and Centers, PHY Program Director Jobs, See Additional PHY Resources, and View PHY Staff. Below this is a search bar for PHY Staff. The main content area features a "Physics (PHY)" header with a background image of Albert Einstein. Below the header, there are three main sections: "PHY Replaces DCL with Solicitation NSF 14-576", "PHY Int'l Activities - Potential Co-Review", and "Special Announcements". The first section contains a paragraph about the solicitation NSF 14-576. The second section contains a paragraph about the Dear Colleague Letter NSF 14-009. The third section contains two links: "MPS Alliances for Graduate Education and the Professoriate - Graduate Research Supplements (AGEP-GRS) Dear Colleague Letter (NSF 13-071)" and "Dear Colleague Letter - Announcement of Instrumentation Fund to Provide Mid-Scale Instrumentation for FY2014 Awards in Physics Division (NSF 13-118)".

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Physics (PHY)

PHY Replaces DCL with Solicitation NSF 14-576

The Physics Division has issued a solicitation (NSF 14-576) for FY2015 that replaces its prior annual Dear Colleague Letter. The solicitation follows most of the requirements in the Grant Proposal Guide, but has additional requirements that relate primarily to proposers who anticipate having multiple sources of support, and proposals involving significant instrumentation development. The solicitation also has deadlines instead of target dates. All proposals submitted to the Physics Division that are not governed by another solicitation (such as CAREER) should be submitted to this solicitation; otherwise they will be returned without review.

PHY Int'l Activities - Potential Co-Review

The Physics Division has issued a Dear Colleague Letter (NSF 14-009) to announce the guidelines for "International Activities within the Physics Division - Potential International Co-Review". The DCL outlines a possible coordinated review of projects involving international colleagues and counterpart funding organizations where a mutual review and funding process is beneficial to the advancement of Physics research. Contact with the appropriate NSF Program Officer is a necessary first step and additional time for this coordination must be allowed. Proposals requesting co-review will be competing with all other proposals in that area and must succeed on the strengths of their intellectual merit and broader impact.

Special Announcements

[MPS Alliances for Graduate Education and the Professoriate - Graduate Research Supplements \(AGEP-GRS\) Dear Colleague Letter \(NSF 13-071\)](#)

[Dear Colleague Letter - Announcement of Instrumentation Fund to Provide Mid-Scale Instrumentation for FY2014 Awards in Physics Division \(NSF 13-118\)](#)

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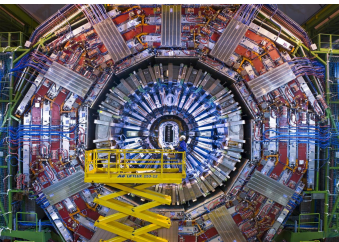
Backup Slides



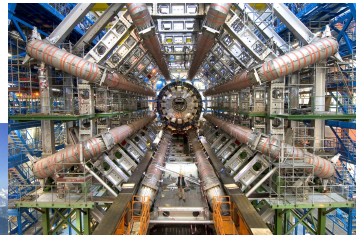


IRIS-HEP: Institute for Research and Innovation in Software for High-Energy Physics [OAC/PHY] - a Software Infrastructure for Sustained Innovation (S2I2) Institute

CMS



ATLAS



High-Luminosity Large Hadron Collider (HL-LHC) upgrade :

- order of magnitude increase in data analysis complexity
 - order of magnitude increase in store and compute cycles
 - solutions needed by : HL-LHC : 2025/2026
-
- Convergence : HPC & Big Data
 - Multi-agency coordination: DoE, +International

IRIS-HEP mission :

- Active center for software R&D
- Intellectual hub for community-wide software R&D
- Transform the operational services and computing model

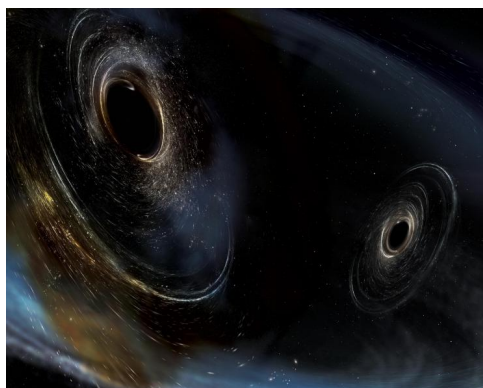
Note : Complements the NSF MREFC for HL-LHC upgrade

Scalable Cyberinfrastructure for Multi-Messenger Astrophysics [OAC/PHY/AST]

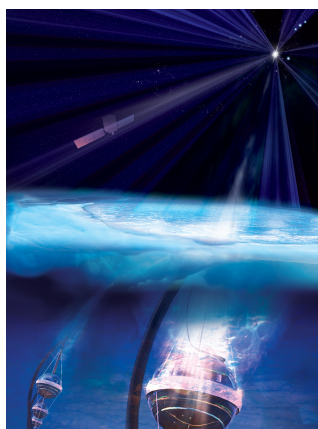
GW170817



GW150914



IceCube-170922A



MMA Challenge :

- Detection, Source Identification, Observation, Simulation
- On the Clock: Time lost is Science Lost!

Community building :

- CiMMA Workshop, UMD, May 2018
- White Paper : MMA - HDR, [arXiv:1807.04780](https://arxiv.org/abs/1807.04780) [astro-ph.IM]
- Community Planning for Scalable CiMMA
- **Convergence: astrophysics, computer science, mathematics, and software engineering**
- Multi-agency coordination: NASA, DoE, **+International**
- Solutions needed by (NSF investment milestones) :
 - LSST : 2023
 - Advanced (A) LIGO : 2020
 - A+ LIGO : 2022/2023
 - IceCube Gen2-Phase 1 : 2023
 - POSS, ZTF, NOAO, NANOGrav, Veritas, AMON, and many others...



NSF 17-548 Ideas Lab: Practical Fully-Connected Quantum Computer
brings together physicists, computer scientists, and engineers to construct a quantum computer capable of showing an advantage over current computer technology.

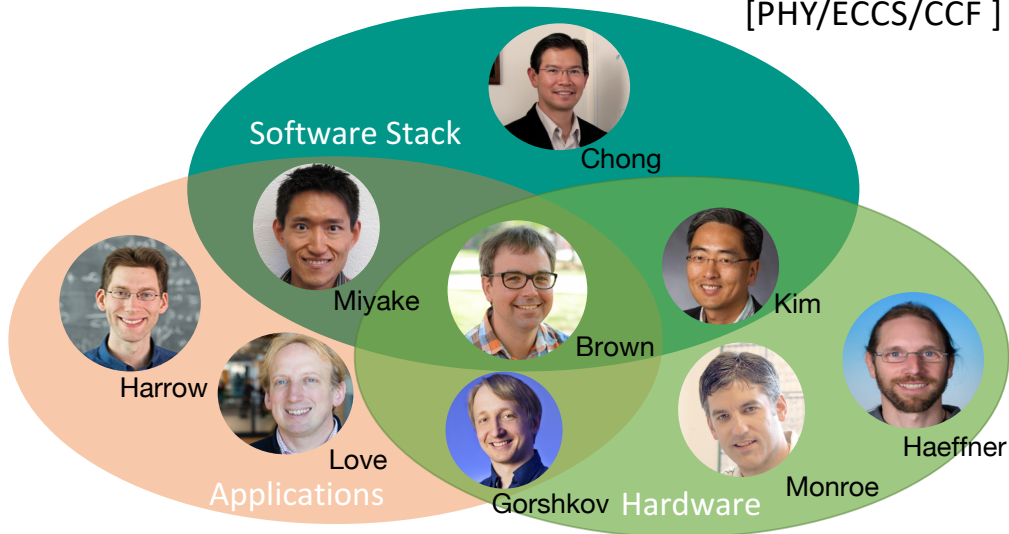
NSF Award 1818914 PFCQC: STAQ: Software-Tailored Architecture for Quantum co-design

\$15 million grant for a multi-institution quantum research collaboration. [News Release 18-058]

Trapped ions (superimposed) above a fabricated trap to capture and control ion qubits (quantum bits).
Image Credit: K. [Hudek](#), Ion Q&E / E. Edwards, JQI



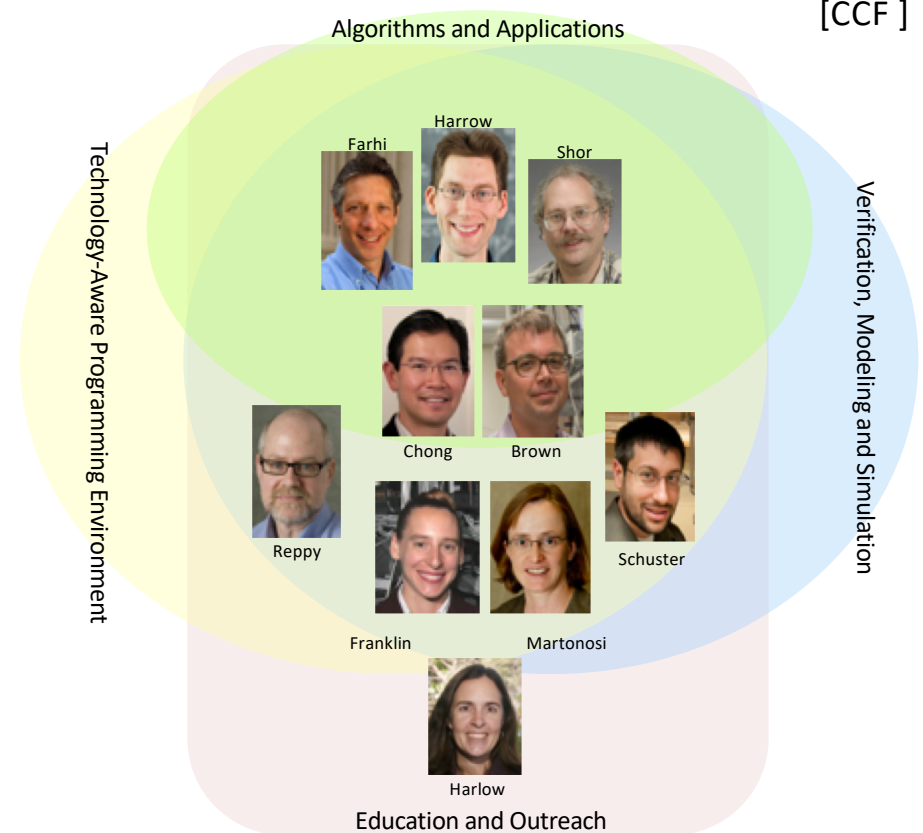
STAQ: Software-Tailored Architecture for Quantum co-design
[PHY/ECCS/CCF]



Solve a challenge problem using quantum computing

- **Convergence:** physical sciences (theory, experiment), engineering, computer science, software engineering
- **Co-design:** architecture, algorithms, software
- **Workforce development**
- **Funding Mechanisms:**
 - *Ideas Lab:* Practical Fully-Connected Quantum Computing challenge (PFCQC)
 - Expeditions in Computing

EPiQC: Enabling Practical-scale Quantum Computation
[CCF]





NSF – DoE Connections in QIS

