

Report from NSF

Edmundo J. Garcia-Solis

Experimental Nuclear Physics
Mathematical and Physical Sciences
National Science Foundation



RHIC & AGS

Annual Users' Meeting

From Protons to Heavy Ions, and Back Again

Hosted By Brookhaven National Laboratory



Outline



- Nuclear Physics at NSF
- Budget
- Funding Opportunities and Highlights
- Final Notes



Goals of the Nuclear Physics Program

- Identify research opportunities and the most compelling physics through the peer review process
- Support as much of the above as possible while managing a balanced portfolio

Nuclear Physics at NSF



- **Nucleon and Hadron QCD** – properties and behavior of nucleons and nuclear matter under extreme conditions, confinement, hadron spectra, nuclear equation of state
- **Nuclear Reactions and Structure** – structure of many-body nuclei and reactions of relevance to structure
Nuclear Astrophysics – origin of the elements, properties of dense matter in a compact object, nuclear reactions that drive stars and stellar explosions
- **Nuclear Precision Measurements and Fundamental Symmetries** – tests of QCD and chiral perturbation theory, tests of the Standard Model in a strongly interacting environment
- **Nuclear Theory** – structure and reactions of nuclei and of hadrons in few-nucleon and nuclear environments, the quark/gluon substructure expressed by QCD

Budget Trends – NSF Nuclear Physics



~ 25% = Research

~ 75% = Operations



Includes co-funding and other leveraged funds

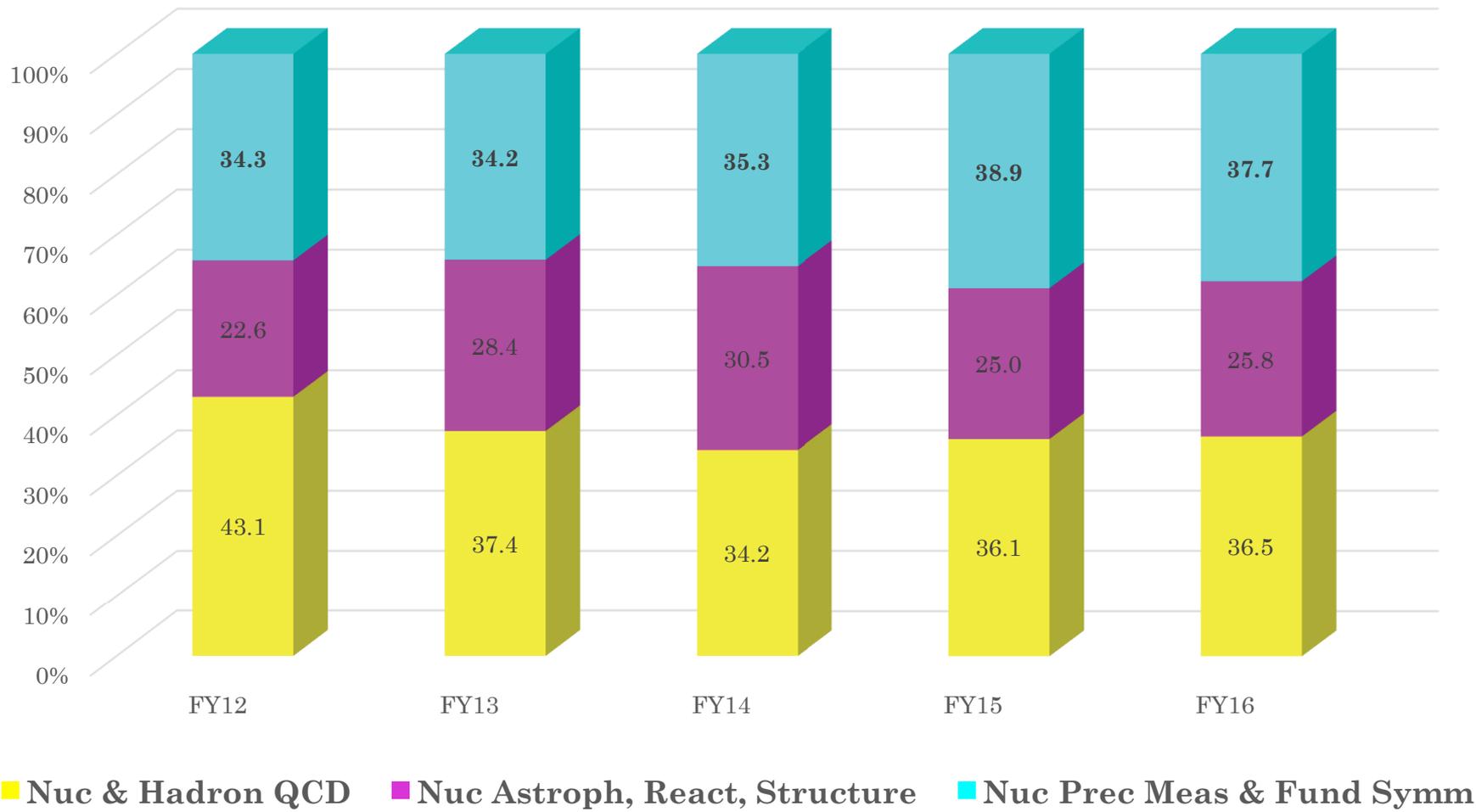
FY	Nucleon & Hadron QCD (k\$)	Nuclear Astroph, Reactions, Structure (k\$)	Prec Meas'ts & Fund. Symm. (k\$)	Total Exp't Nuclear Physics (k\$)	Nuclear Theory (k\$)	Nuclear Program Total (k\$)	NSCL (k\$)	JINA & JINA -CEE (k\$)	MRI (K\$)	Mid-Scale (K\$)	Total Nuclear Physics (k\$)
2011				19,164	3,719	22,883	21,500	2,150	729		47,262
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				17,800			24,000	2,280		2,990	

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 (nEDM & MUSE)

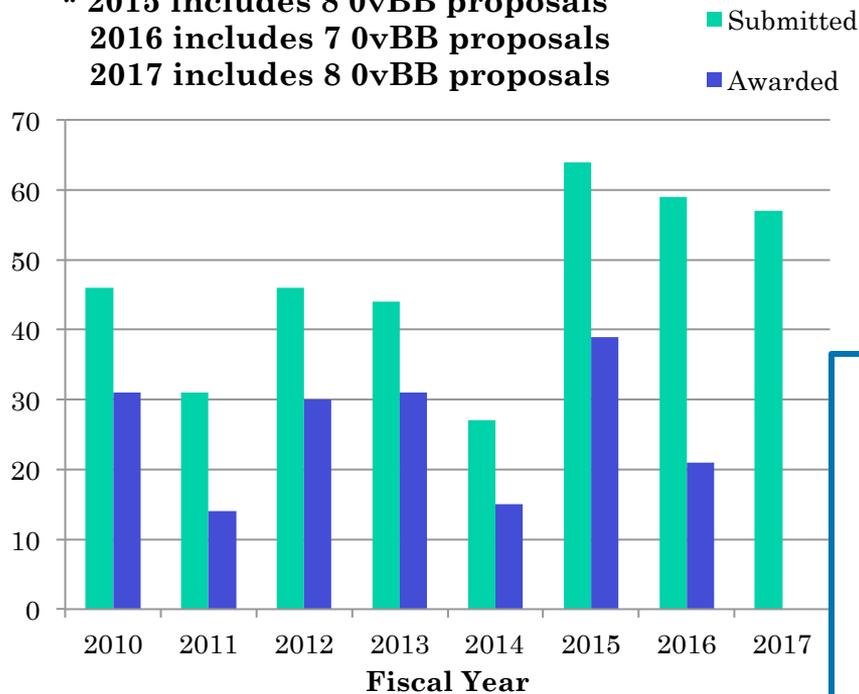
Budget Trends – NSF Nuclear Physics





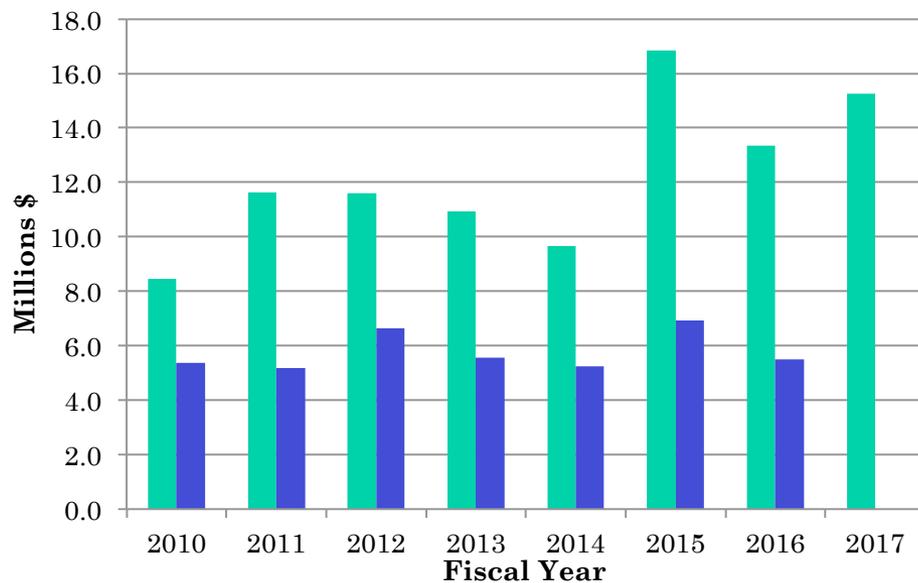
ENP Proposal Trends

* 2015 includes 8 0vBB proposals
2016 includes 7 0vBB proposals
2017 includes 8 0vBB proposals



ENP Funding Trends New awards only

Requested funds 1st yr (M\$)
Awarded Funds 1st yr (M\$)



FY18 NSF Request \$6,652.89 M



National Science Foundation FY 2018 Budget Request to Congress (Dollars in Millions)

NSF by Account	FY 2017			FY 2018 Request change over	
	FY 2016 Actual	Annualized CR	FY 2018 Request	Amount	Percent
Research & Related Activities	\$5,998.09	\$6,022.18	\$5,361.65	-\$636.44	-10.6%
Education & Human Resources	\$884.10	\$878.33	\$760.55	-\$123.55	-14.0%
Major Research Equipment & Facilities Construction	\$241.50	\$199.93	\$182.80	-\$58.70	-24.3%
Agency Operations & Award Management	\$351.11	\$329.37	\$328.51	-\$22.60	-6.4%
National Science Board	\$4.31	\$4.36	\$4.37	\$0.06	1.5%
Office of Inspector General	\$14.76	\$15.13	\$15.01	\$0.25	1.7%
Total, NSF	\$7,493.86	\$7,449.30	\$6,652.89	-\$840.98	-11.2%

FY18 PHY \$253.30M



- Approximately 2% for Operations
 - Panels, IPA Appointments and Travel, M&S
- Approximately 30% for M&O for Facilities
 - IceCube, LHC, LIGO, NSCL
- Approximately 8% for Physics Frontiers Centers
 - Currently 5 (one of which is JINA-CEE); near end of tri-annual competition
- Approximately 3% for Education and Broadening Participation
 - REU Sites, LIGO Education Center, ...
- Approximately 57% (\$152.09 M) for six major areas of Physics (AMO, PP, GP, NP, PA, PoLS)
 - Experimental and Theoretical



FY18 PHY \$253.30M

PHY Funding

(Dollars in Millions)

	FY 2016 Actual	FY 2017 (TBD)	FY 2018 Request	Change Over FY 2016 Actual Amount	Percent
Total	\$276.91	-	\$253.30	-\$23.61	-8.5%
Research	174.12	-	152.09	-22.03	-12.7%
CAREER	8.12	-	7.30	-0.82	-10.1%
STC: Center for Bright Beams (CBB)	-	-	5.00	5.00	N/A
Education	5.40	-	4.80	-0.60	-11.1%
Infrastructure	97.39	-	96.41	-0.98	-1.0%
IceCube	3.48	-	3.50	0.02	0.6%
Large Hadron Collider (LHC)	20.00	-	16.00	-4.00	-20.0%
Laser Interferometer Gravitational Wave Observatory (LIGO)	39.43	-	39.43	-	-
Nat'l Superconducting Cyclotron Lab. (NSCL)	24.00	-	23.00	-1.00	-4.2%
Midscale Research Infrastructure	10.48	-	8.18	-2.30	-21.9%
Pre-construction planning:	-	-	6.30	6.30	N/A
High-Luminosity LHC Upgrade Planning	-	-	6.30	6.30	N/A

Awards made in FY17 (ENP):

yr1 = \$XXX yr2 = \$(XXX)*0.9 yr3 = \$(XXX)*0.9



Goals of the Nuclear Physics Program

- Identify research opportunities and the most compelling physics through the peer review process
- Support as much of the above as possible while managing a balanced portfolio

Our goals and actions remain the same –
regardless of the budget



NSF Physics Division: Investigator-Initiated Research Projects (17-561)

- Proposals to the Nuclear Physics Program for schools, workshops and conferences, must be submitted through this solicitation.
 - Priority will be given to schools.
 - Broad scope that serves a wide nuclear physics community
 - Involvement of under-represented groups
 - Contact us!
- **However:** Research at Undergraduate Institutions (RUI) proposals should be submitted through the RUI solicitation (14-579) by the deadlines in this PHY solicitation according to the closest disciplinary match.

Ohio State group at STAR & ALICE

- particle femtoscopy – novel correlations
- global polarization discovery
- STAR EPD detector upgrade



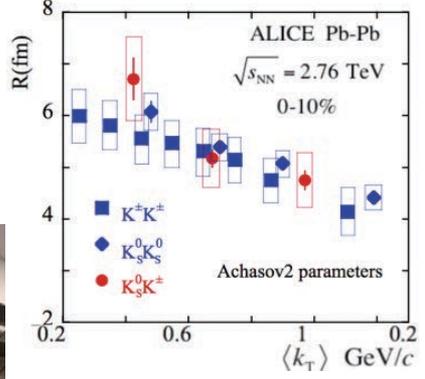
Tom Humanic



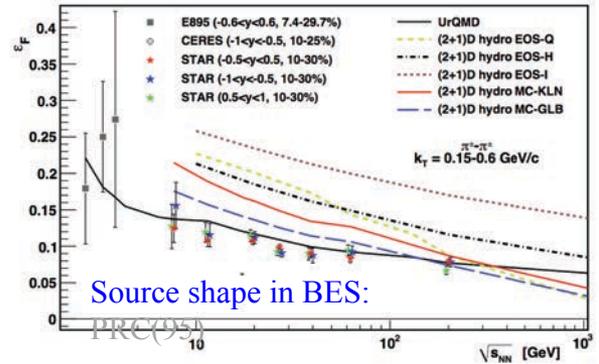
Mike Lisa



Undergrads in the lab



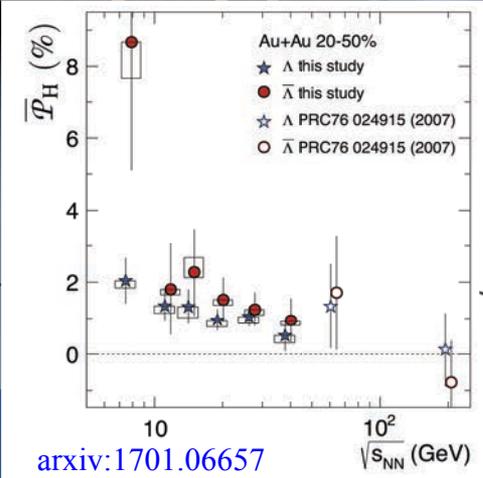
flow thru novel correlations
arXiv:1705.04929; sub PRB



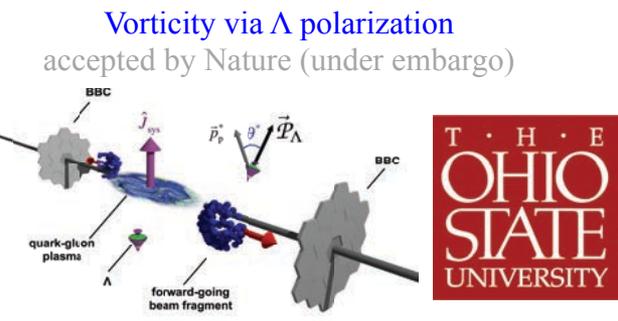
Source shape in BES:



STAR Event Plane Detector



arxiv:1701.06657



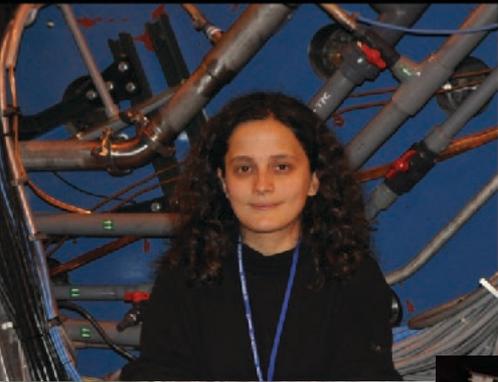
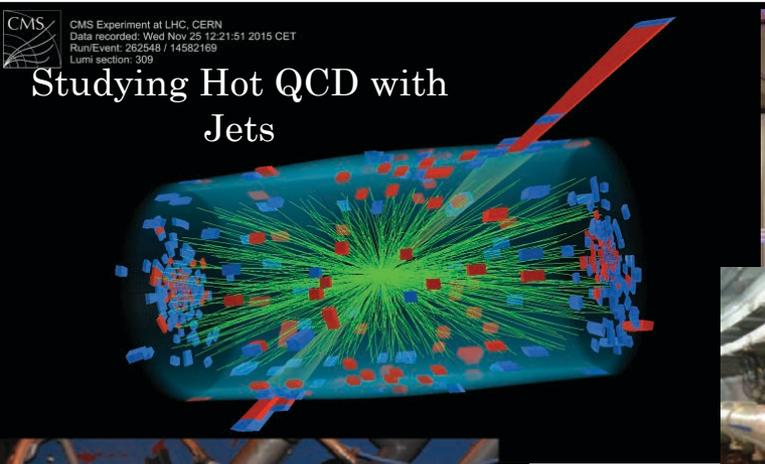


Career Program

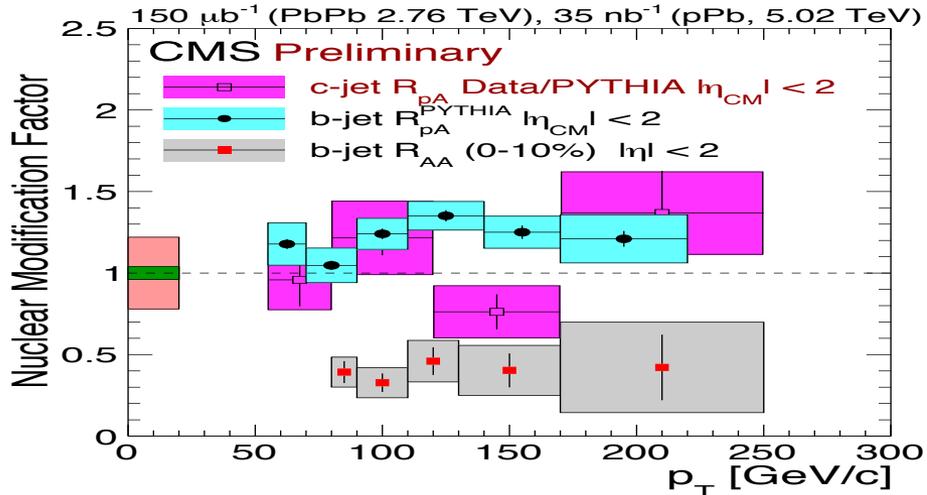
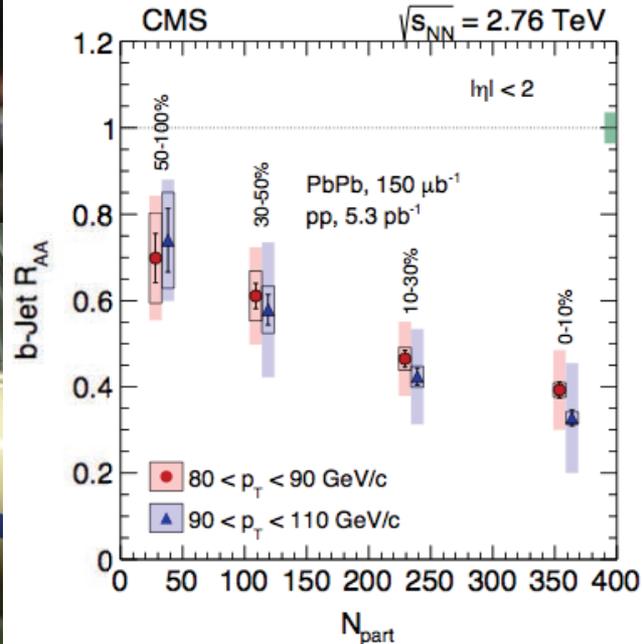
- Solicitation: 17-537
- Must include excellent research proposal as well as excellent educational plan
- There are eligibility requirements: e.g., must be assistant professor, untenured
- 5 year awards, \$400,000 minimum
- Proposal deadline: **July 21, 2017**
- PECASE nominees are chosen from CAREER winners
- Contact program officer for information/advice ahead of time (budget, scope)

FY17: 8 ENP proposals; 2 awarded
Jaideep Singh @ MSU & Liang Yang @ UIUC

CMS at the LHC



Sevil Salur



Major Research Instrumentation (MRI) NSF 15-504



- Two types of awards: development and acquisition
- Contact program directors well ahead of submission to discuss (avoid pitfalls)
- Limited submissions from each university
- Maximum award is \$4M; awards above \$1M compete across the entire Foundation

FY17

- *Physics received 23 proposals, 10 in ENP*
 - *Review process complete*
 - *Funding recommendations soon*

FY18

- **Likely to be a new solicitation**



FNAL Muon g-2 NSF MRI

Washington / Cornell / Illinois / Kentucky / JMU/
UVA





Midscale Instrumentation

- Design and Construction *or* Acquisition of Instrumentation
 - R & early D, operations funded by research programs
- $\sim \$4\text{M} < \text{TPC} < \sim \15M ; over multiple years
- Selection based on
 - merit review
 - exceptional opportunity
 - research community priorities.
- Currently 6 Midscale projects
- For more info, see PHY Solicitation 17-561

MUSE

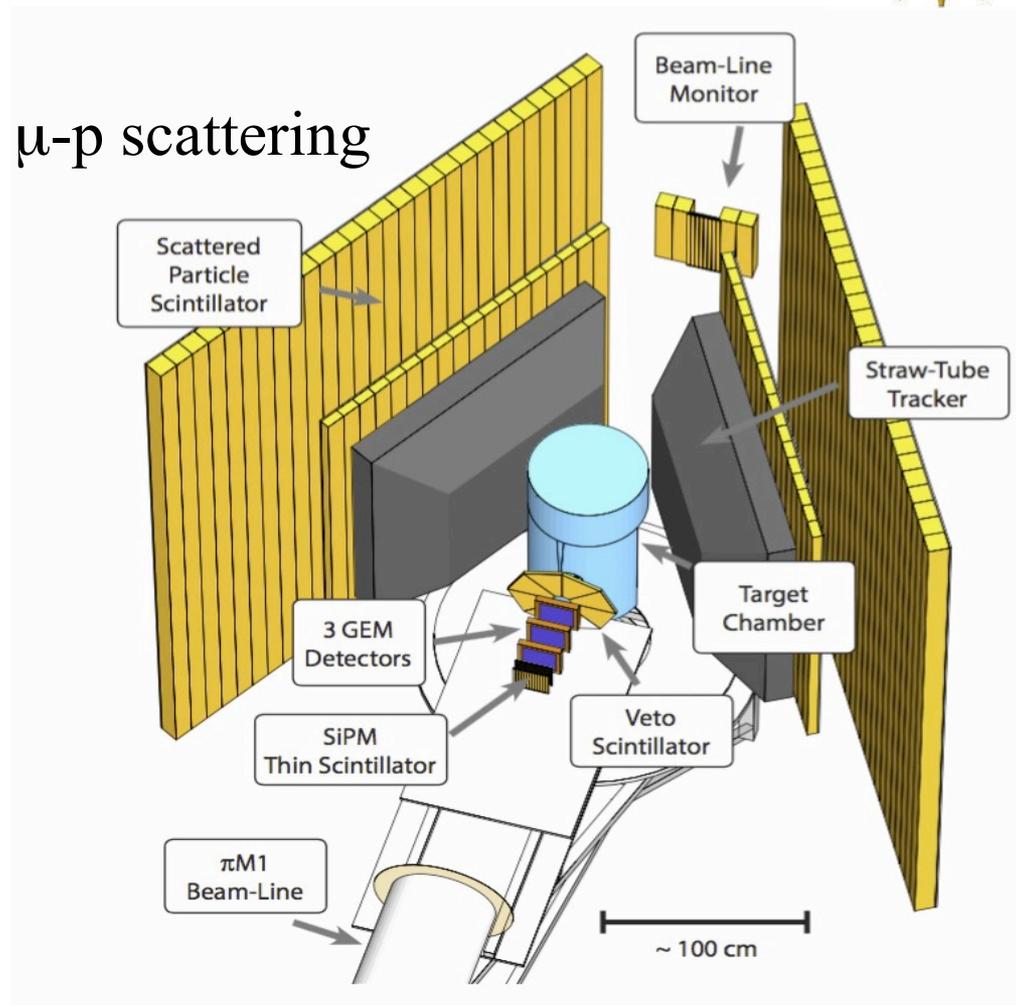
Experimental Nuclear Physics

Precise comparison of e-p and μ -p scattering
Proton charge radius

@ Paul Scherrer Institute

Currently in a month-long
test run

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





Midscale: Upgrades to LHC Experiments

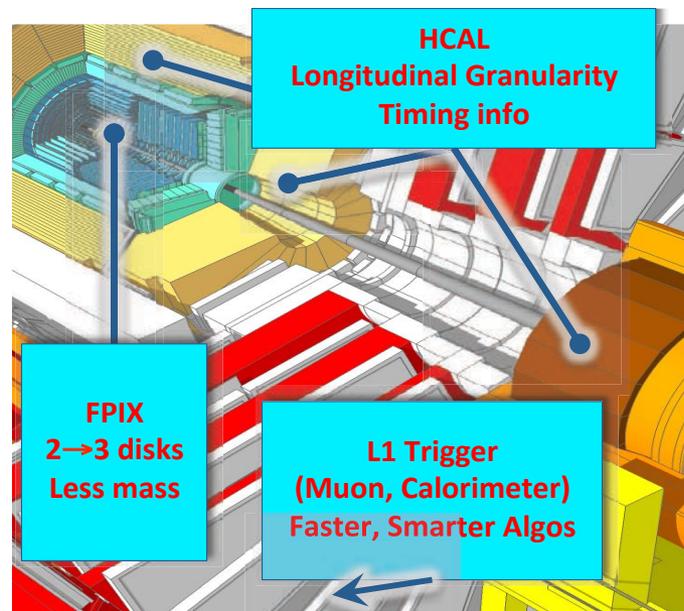
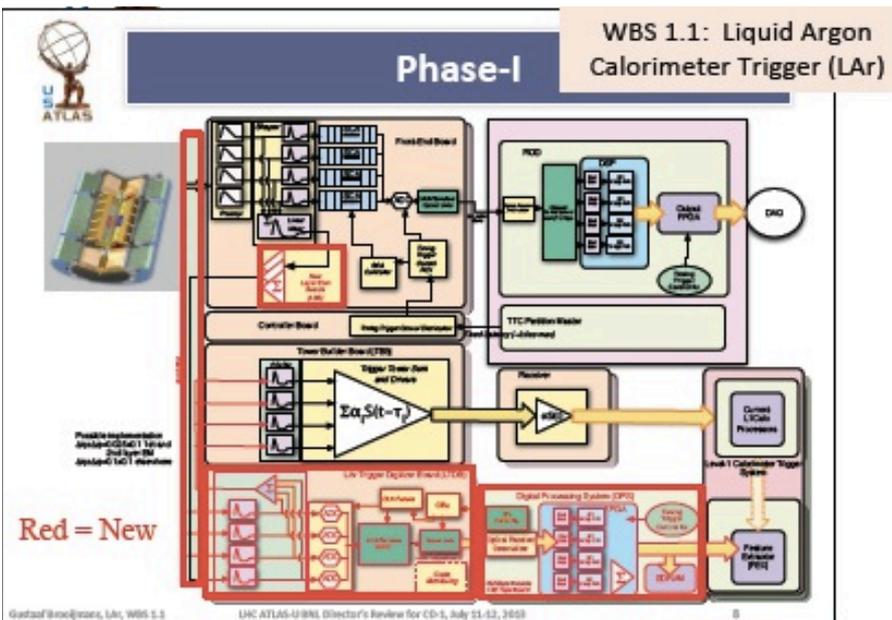
Elementary Particle Physics

ATLAS

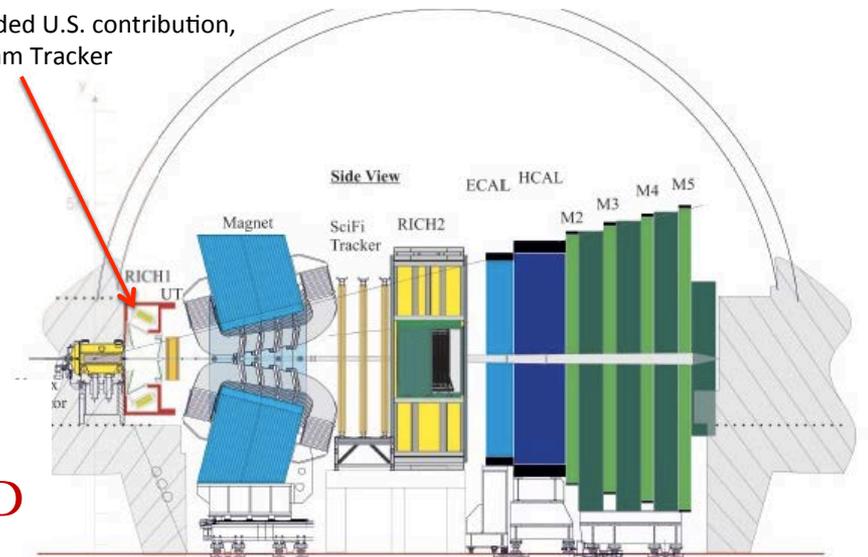
Lead: SUNY-Stony Brook

CMS

Lead: U. Nebraska /Catholic



NSF funded U.S. contribution,
Upstream Tracker



LHCb

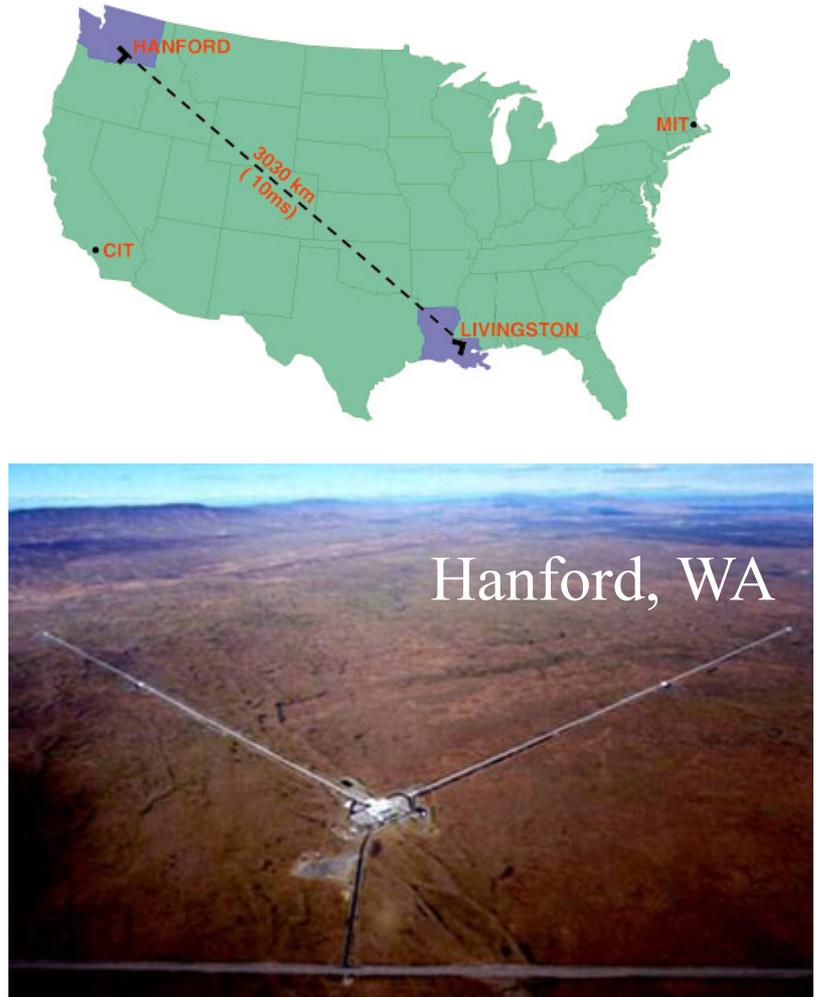
Leads: Syracuse, Cincinnati, MIT, UMD

Major Research Equipment and Facilities Construction (MREFC)



- The Major Research Equipment and Facilities Construction (MREFC) account supports the acquisition, construction, and commissioning of major research facilities and equipment that provide unique capabilities at the frontiers of science and engineering.
- Initial planning, design, and post-construction operations and maintenance are funded through the Research and Related Activities (R&RA) account.

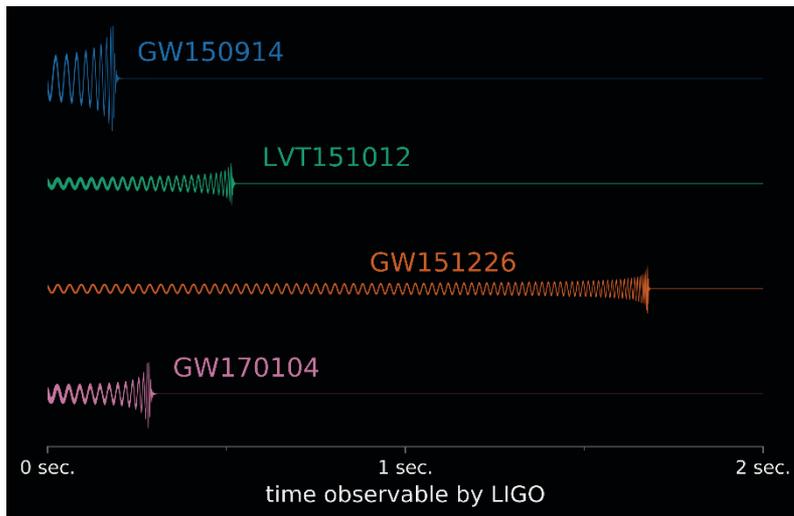
Laser Interferometer Gravitational-Wave Observatory (LIGO)



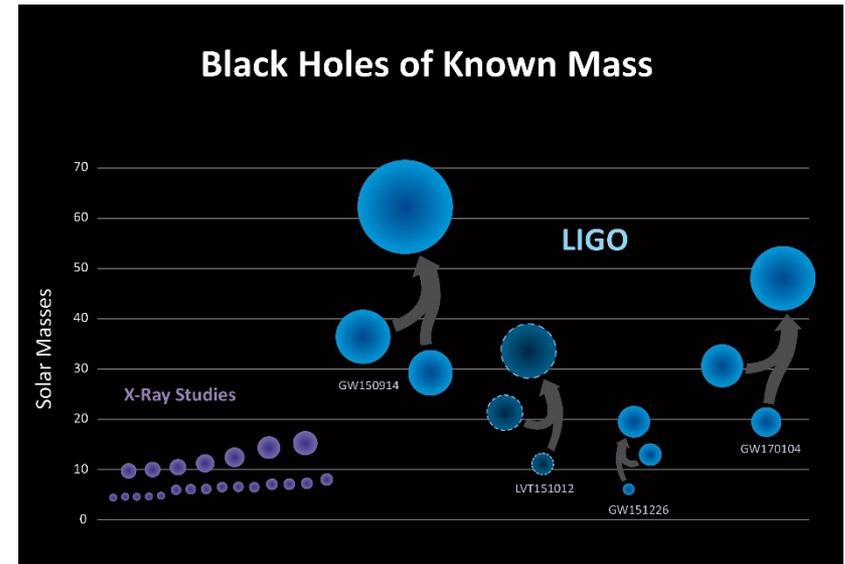
May 2017: Third Confirmed LIGO Detection GW170104



Likely that in this merger the BH spins were initially *counter* aligned with the orbital angular momentum, unlike previous two detections.



Images: LIGO.org



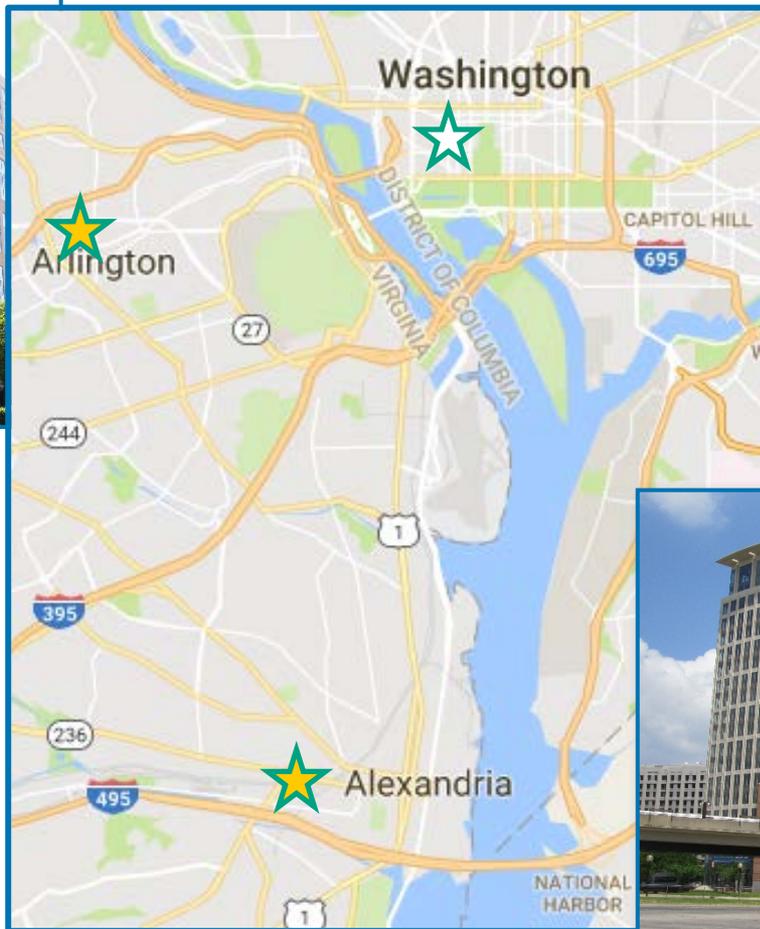
Original Black Holes Masses: 19 and 31 M_{\odot} .
Final Black Hole Mass: 49 M_{\odot}
Distance: 880 Mpc ($z = 0.18$).

Previously detected merged BH:
1st = 62 M_{\odot} 2nd = 21 M_{\odot}

The farthest detection so far



NSF is Moving



NSF/MPS/Physics Personnel

- **France Córdova** – Director
- **James Ulvestad** – Acting Assistant Director for MPS
- **Denise Caldwell** – Physics Division Director
- **Brad Keister** – Deputy Division Director
- **Bogdan Mihaila** – Nuclear Theory Program Director
- **Allena Opper** – Expt'l Nuclear Physics Program Director
- **Edmundo Garcia** – Expt'l Nuclear Physics Program Director

For the latest updates, check out

<http://www.nsf.gov/div/index.jsp?div=PHY>

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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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