

NSF Report: Division of Physics Particle Physics

Jim Shank, Keith Dienes
National Science Foundation
Division of Physics
FNAL Users Meeting
August 2, 2021



NSF Particle Physics Programs

- Transitions in Physics Division (PHY)
- Status of EPP Exp and THY Programs
- Funding opportunities



Division of Physics – Individual Investigator Programs

Atomic, Molecular, & Optical Physics

Experiment: John Gillaspy, Kevin Jones, Tony Calamai
Theory: Robert Forrey

Plasma Physics

Slava Lukin, Jose Lopez

Elementary Particle Physics

Experiment: Jim Shank
Theory: Keith Dienes

Particle Astrophysics

Experiment: Darren Grant
Theory (+cosmology): Keith Dienes

Gravitational Physics + LIGO research

Pedro Marronetti

Nuclear Physics

Experiment: Allena Opper; Jim Thomas
Theory: Bogdan Mihaila

Physics of Living Systems

Krastan Blagoev

Quantum Information Science

(Alex Cronin); Julio Gea-Banacloche

Notable transitions:

- Edmundo Garcia-Solis has left NSF
- Saul Gonzales has left the PHY division
- Jim Whitmore has retired

Physics at the Information Frontier
Bogdan Mihaila

Integrative Activities in Physics
(REU Sites, MRI, CAREER, BP) Kathy McCloud (soon)

Physics Frontiers Centers
Jim Shank



**NATIONAL SCIENCE FOUNDATION
SUMMARY TABLE
FY 2022 BUDGET REQUEST TO CONGRESS**
(Dollars in Millions)

| NSF by Account | FY 2020 | | | | FY 2022 Request change over: | | | |
|---|-------------------|----------------|----------------------|--------------------|------------------------------|--------------|-------------------|---------------|
| | FY 2020 | CARES | FY 2021 | FY 2022 | FY 2020 Actual | | FY 2021 Enacted | |
| | Actual | Act | Enacted ¹ | Request | Amount | Percent | Amount | Percent |
| BIO | \$809.31 | \$19.00 | - | \$948.51 | \$139.20 | 17.2% | N/A | N/A |
| CISE | 996.40 | 15.00 | - | 1,116.06 | 119.66 | 12.0% | N/A | N/A |
| ENG | 754.31 | 15.00 | - | 916.79 | 162.48 | 21.5% | N/A | N/A |
| GEO | 993.72 | - | - | 1,194.92 | 201.20 | 20.2% | N/A | N/A |
| MPS | 1,530.12 | 6.00 | - | 1,690.74 | 160.62 | 10.5% | N/A | N/A |
| SBE | 280.35 | 9.50 | - | 319.66 | 39.31 | 14.0% | N/A | N/A |
| TIP ² | 352.31 | 3.55 | - | 864.87 | 512.56 | 145.5% | N/A | N/A |
| <i>TIP Programs</i> | 120.25 | 0.80 | - | 590.23 | 469.98 | 390.8% | N/A | N/A |
| <i>SBIR/STTR, including Operations</i> | 232.06 | 2.75 | - | 274.64 | 42.58 | 18.3% | N/A | N/A |
| OISE | 51.04 | - | - | 75.32 | 24.28 | 47.6% | N/A | N/A |
| OPP | 480.59 | - | - | 506.29 | 25.70 | 5.3% | N/A | N/A |
| IA ³ | 352.97 | 1.95 | - | 504.90 | 151.93 | 43.0% | N/A | N/A |
| U.S. Arctic Research Commission | 1.60 | - | - | 1.65 | 0.05 | 3.1% | N/A | N/A |
| Research & Related Activities | \$6,602.70 | \$70.00 | \$6,909.77 | \$8,139.71 | \$1,537.01 | 23.3% | \$1,229.94 | 17.8% |
| Education & Human Resources³ | \$1,084.24 | \$5.00 | \$968.00 | \$1,287.27 | \$203.03 | 18.7% | \$319.27 | 33.0% |
| Major Research Equipment & Facilities Construction | \$154.84 | - | \$241.00 | \$249.00 | \$94.16 | 60.8% | \$8.00 | 3.3% |
| Agency Operations & Award Management | \$347.58 | \$1.00 | \$345.64 | \$468.30 | \$120.72 | 34.7% | \$122.66 | 35.5% |
| Office of Inspector General | \$16.30 | - | \$17.85 | \$20.42 | \$4.12 | 25.2% | \$2.57 | 14.4% |
| Office of the National Science Board | \$4.43 | - | \$4.50 | \$4.60 | \$0.17 | 3.9% | \$0.10 | 2.2% |
| Total, NSF Discretionary Funding | \$8,210.09 | \$76.00 | \$8,486.76 | \$10,169.30 | \$1,959.21 | 23.9% | \$1,682.54 | 19.8% |
| Education and Human Resources - H-1B Visa Donations | 114.78 | - | 157.00 | 162.47 | 47.69 | 41.6% | 5.47 | 3.5% |
| Total, NSF Mandatory Funding | \$135.83 | - | \$197.00 | \$172.47 | \$36.64 | 27.0% | -\$24.53 | -12.5% |
| Total, NSF Budgetary Resources | \$8,345.92 | \$76.00 | \$8,683.76 | \$10,341.77 | \$1,995.85 | 23.9% | \$1,658.01 | 19.1% |

FY2022 President's Request



Major Research Equipment Account

FY2022 President's budget request

MREFC Account Funding, by Project

(Dollars in Millions)

| | FY 2020 Actual | FY 2021 Estimate ¹ | FY 2022 Request | FY 2023 Estimate | FY 2024 Estimate | FY 2025 Estimate | FY 2026 Estimate | FY 2027 Estimate |
|--|-------------------|----------------------------------|--------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Antarctic Infrastructure Recapitalization | \$48.78 | \$90.00 | \$90.00 | \$60.00 | \$60.00 | TBD | TBD | TBD |
| DKIST | - | - | - | - | - | - | - | - |
| HL-LHC Upgrade | 33.00 | 33.00 | 36.00 | 33.00 | 18.00 | - | - | - |
| Mid-scale Research Infrastructure ² | - | 76.25 | 76.25 | 76.25 | 76.25 | 76.25 | 76.25 | 76.25 |
| NEON | 0.74 | - | - | - | - | - | - | - |
| RCRV | 25.00 | - | 5.00 | 15.00 | - | - | - | - |
| Vera C. Rubin Observatory | 46.35 | 40.75 | 40.75 | 15.00 | - | - | - | - |
| Dedicated Construction Oversight | 0.97 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Total | \$154.84 | \$241.00 | \$249.00 | \$200.25 | \$155.25 | \$77.25 | \$77.25 | \$77.25 |



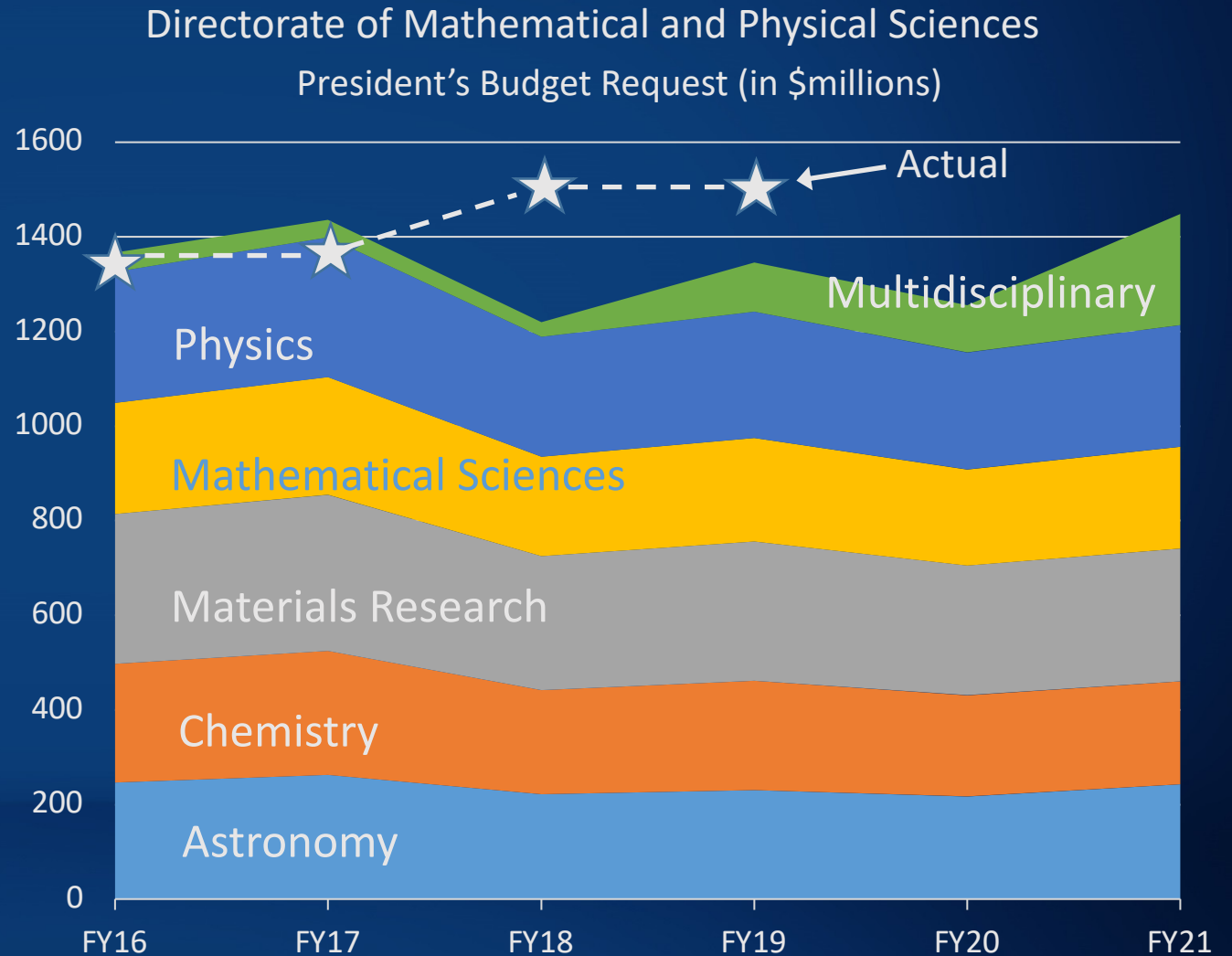
FY2022 President's budget request

| PHY Funding | | | | | |
|---|-------------------|---------------------|--------------------|---------------------------------|---------|
| (Dollars in Millions) | | | | | |
| | FY 2020 Actual | FY 2021 Estimate | FY 2022 Request | Change over FY 2021 Estimate | |
| | | | | Amount | Percent |
| Total | \$304.39 | \$303.90 | \$316.59 | \$12.69 | 4.2% |
| Research | 175.08 | 187.32 | 203.22 | 15.90 | 8.5% |
| CAREER | 10.24 | 7.30 | 7.30 | - | - |
| Centers Funding (total) | 7.45 | 7.70 | 11.00 | 3.30 | 42.9% |
| Artificial Intelligence Research Institutes | 2.79 | 2.70 | 6.00 | 3.30 | 122.2% |
| STC: Center for Bright Beams (PHY) | 4.66 | 5.00 | 5.00 | - | - |
| Education | 5.76 | 4.92 | 4.92 | - | - |
| Infrastructure | 105.86 | 96.66 | 90.15 | -6.51 | -6.7% |
| IceCube | 3.50 | 3.50 | 3.65 | 0.15 | 4.3% |
| LHC | 20.00 | 20.00 | 20.50 | 0.50 | 2.5% |
| LIGO | 45.00 | 45.00 | 45.00 | - | - |
| Midscale Research Infrastructure | 15.36 | 12.66 | 18.50 | 5.84 | 46.1% |
| NSCL | 22.00 | 15.50 | 2.50 | -13.00 | -83.9% |
| Research Resources | - | 1.00 | 2.50 | 1.50 | 150.0% |



Physics Funding at NSF

- PHY FY21 Request is 9.6% *below* FY19 Actual
- Particle physics funding is ~1/3 of Physics budget
- Increasing importance of NSF multidisciplinary “Big Ideas”
- Overall, FY20 enacted is ~3% *above* FY19 Actual for NSF



Particle Physics Research Programs



Experimental EPP Program

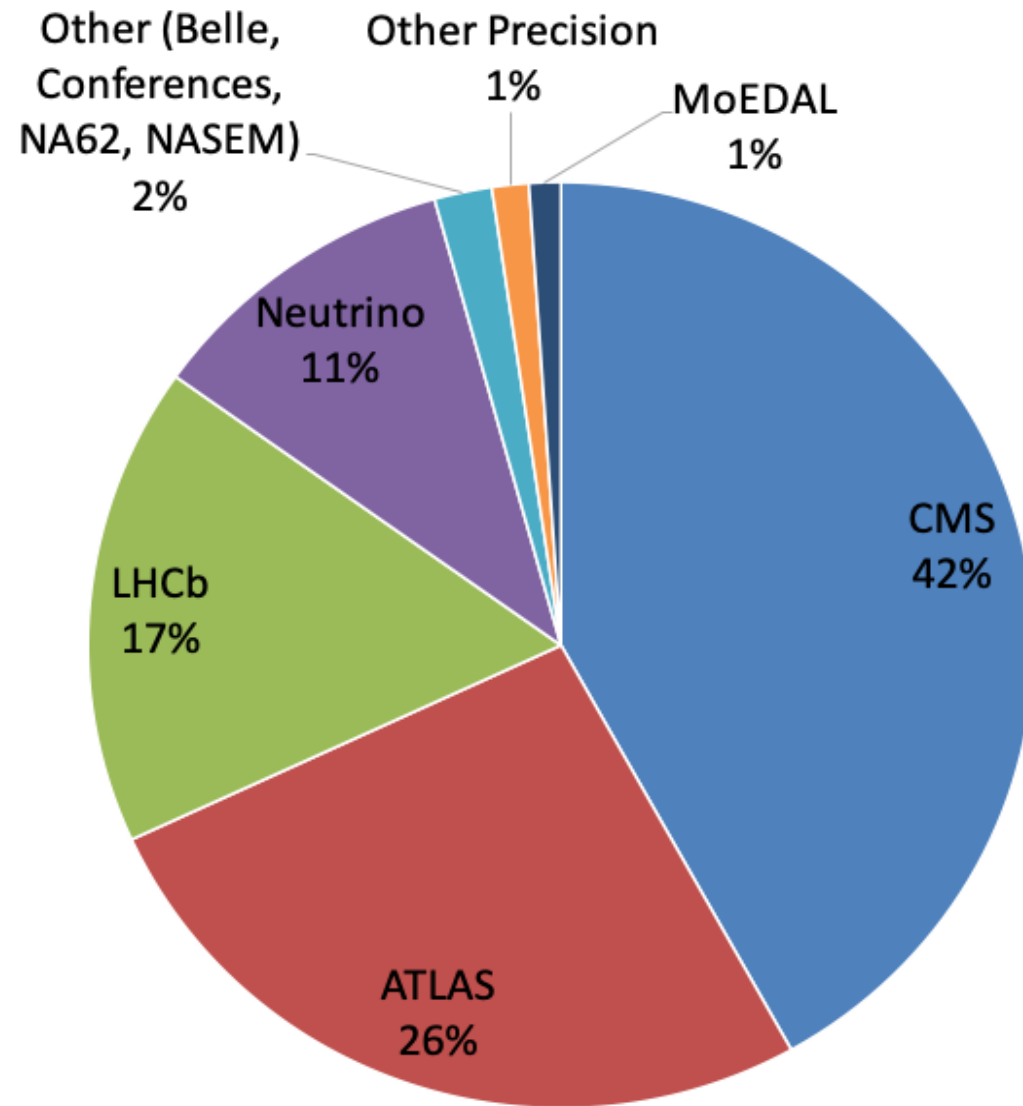
- Elementary Particle Physics (EPP) Program, which primarily supports particle physics at accelerators and advances in detector development.
- Range of program coverage:
 - High Energy Physics (ATLAS, CMS,...)
 - Precision Experiments (Neutrinos, LHCb, Rare-K, EDMs, ...), LHCb M&O
 - Tools for Particle Physics (Artificial Intelligence, Instrumentation,...)

Program Directors: S. Gonzalez, J. Shank

| EPP Program | FY 2015 | FY 2016 | FY 2017 | FY 2018 | FY 2019 | FY 2020 |
|------------------|----------|----------|----------|----------|----------|----------|
| Funding (in \$k) | \$19,913 | \$19,183 | \$19,133 | \$20,522 | \$17,325 | \$21,090 |
| Awards issued | 19 | 12 | 7 | 18 | 15 | 15 |
| CAREER awards | 1 | 2 | 1 | 1 | 0 | 3 |



EPP FY 20 Funding distribution



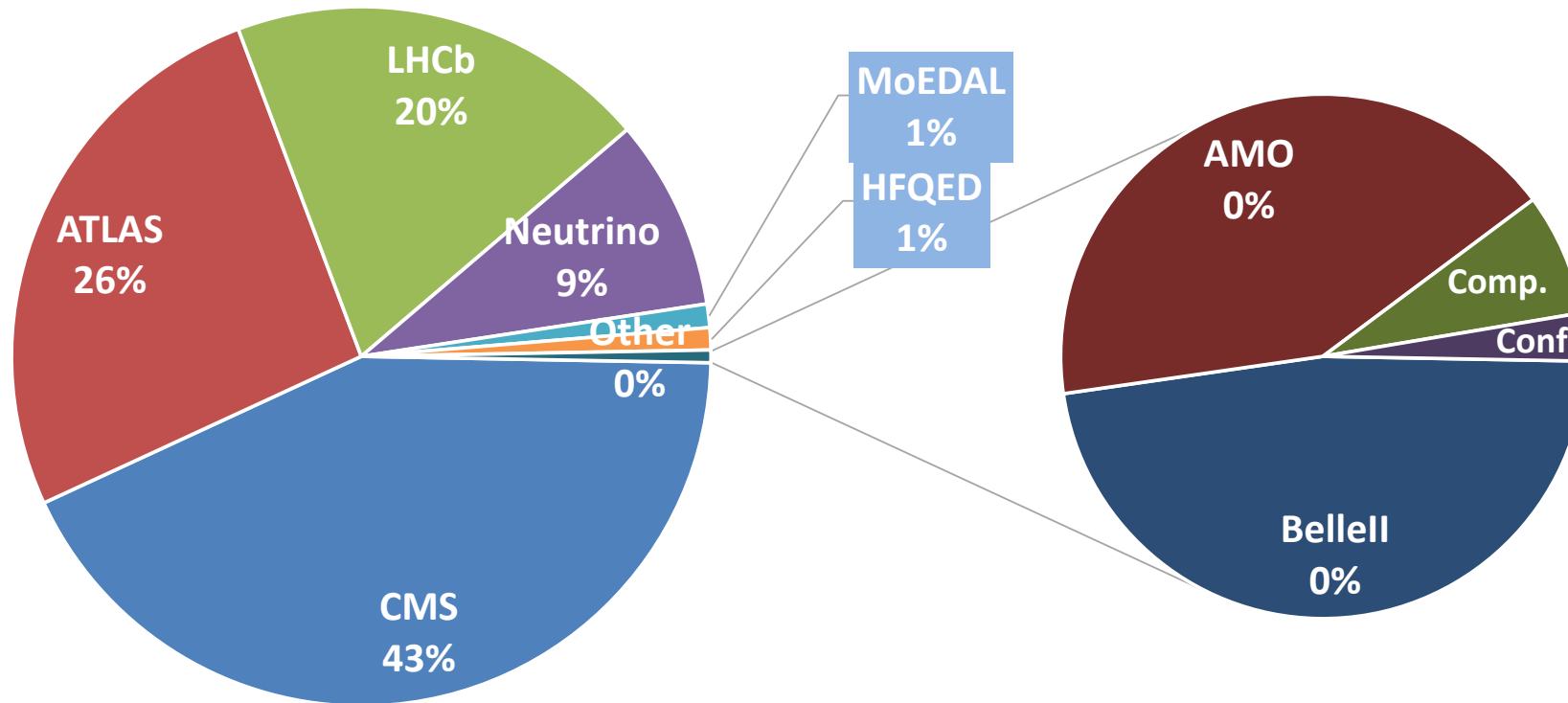
The awards from 2020 proposals.



Full EPP program at the end of 2020

FY 20 Supported Science Areas EPP/Experiment (HEP, TPP, PPP)

All awards by
fraction of
FY20 budget.



Theory Program for Particle Physics

- Particle Theory is essential to the success of the entire Particle Physics mission. We support cutting-edge investigator-driven research in two programs:
 - Theoretical High-Energy Physics
 - Theoretical Particle Astrophysics and Cosmology
- Regular interactions with EPP, PA, Gravity Theory, Nuclear Theory, Astronomy, Materials Research, Mathematical Sciences, etc.
- Supporting individuals, RUI's, and special facilities or initiatives (Aspen Center for Physics, TASI summer school, LHC Theory Initiative, etc.)
- Trend: Dramatic increase in number of proposals—factor of two in last 5 years, +20% last year

Program Director: K. Dienes

| Theory Programs | FY 2015 | FY 2016 | FY 2017 | FY 2018 | FY 2019 | FY 2020 |
|------------------|----------|----------|----------|----------|----------|----------|
| Funding (in \$k) | \$13,751 | \$13,232 | \$13,388 | \$13,427 | \$12,029 | \$13,559 |
| Awards issued | 28 | 30 | 26 | 32 | 23 | 32 |
| CAREER awards | 2 | 1 | 2 | 1 | 1 | 1 |



Primary NSF Physics Funding Opportunities

(relevant for high-energy physics, particle astrophysics, and cosmology)



- <https://www.nsf.gov/pubs/2021/nsf21593/nsf21593.htm>: **Our general, all-purpose Solicitation for our regular base grants. Use this as your default.** Deadlines in Fall 2021, depending on specific program.
- <https://www.nsf.gov/pubs/2014/nsf14579/nsf14579.htm>. (“RUI”) Same as above, but for applicants from primarily undergraduate institutions. Check eligibility with your SRO.
- <https://www.nsf.gov/pubs/2020/nsf20525/nsf20525.htm>: (“CAREER”) An alternative funding track for those junior (untenured) faculty who, at this point in their careers, wish to undertake a *significant education/outreach activity* in addition to their research. **Not simply a research-excellence prize, and not intended as a default for junior faculty unless you plan a major mix of research and education/outreach.** Next deadline: July 26, 2021.
- <https://www.nsf.gov/pubs/2021/nsf21570/nsf21570.htm>: (“LEAPS-MPS”) Grants designed to “*launch* the careers of pre-tenure faculty... at minority-serving institutions (MSIs), predominantly undergraduate institutions (PUIs), and Carnegie Research 2 (R2) universities ... with the goal of achieving excellence through diversity.” *Launch* = you have no prior or current NSF grants (see special exceptions). Deadline for FY22 not yet determined.
- [Supplements to existing NSF grants to fund a new graduate student](#). Emphasis placed on “increasing the involvement by members of underrepresented groups”. Apply anytime, fall preferred.
 - <https://www.nsf.gov/pubs/2020/nsf20083/nsf20083.jsp>: “MPS AGEP-GRS” (only for allowed institutions).
 - <https://www.nsf.gov/pubs/2021/nsf21065/nsf21065.jsp>: “PHY-GRS” (similar, but for remaining institutions).
- <https://www.nsf.gov/pubs/2021/nsf21573/nsf21573.htm>: (“MPS-Ascend”) Fellowships to “support postdoctoral Fellows who will broaden the participation of under-represented groups”. Postdocs or graduating PhDs apply on their own after identifying a potential postdoctoral mentor. Deadline for FY22 not yet determined
- [Other Divisions, such as Division of Astronomy](#). Contact relevant Program Directors in both Divisions.

Proposal & Award
Policies & Procedures
Guide:

**New PAPPG
in effect
Oct. 4!**

https://www.nsf.gov/pubs/policydocs/pappg22_1/index.jsp

PHY Contacts:

- **Jim Shank** (jshank@nsf.gov) -- HEP Experiment
- **Keith Dienes** (kdienes@nsf.gov) -- HEP Theory & Particle Astro/Cosmo Theory
- **Darren Grant** (dgrant@nsf.gov) -- Particle Astro Experiment
- **Kathy McCloud** (kmcccloud@nsf.gov) -- for LEAPS-MPS and MPS-Ascend

Research Infrastructure



Mid-Scale Research Infrastructure

- Webinar from Nov. 2020: [weblink](#)
- Mid-Scale RI-1 Solicitation: [21-505](#)
- Preliminary Proposal Deadline Date: January 7, 2021
- **Full Proposal Deadline Date:** April 23, 2021 (By Invitation Only)
- Mid-Scale RI-1 Implementation projects Total cost: \$6M - \$20M
- Mid-Scale RI-1 Design projects Total cost: \$600k - \$20M
- Mid-Scale RI-2 Solicitation: [21-537](#)
- Letter of Intent Deadline Date: **Feb.3, 2021** , Prelim proposal: Mar. 5, Full: Sept. 20, 2021
- Mid-Scale RI-2 Projects Total cost: \$20M - \$100M
- Consult the Major Facilities Guide [NSF 19-068](#)

