National Science Foundation – Nuclear Physics

Outline
- Staff
- Funding Announcements
- FY22 Budget Info
- Highlights
NSF/MPS/PHY Personnel

- Sethuraman Panchanathan – Director
- Sean L. Jones – Assistant Director for MPS
- Denise Caldwell – Physics Division Director
- Jean Cottam Alan – Deputy Division Director
- Bogdan Mihaila – Nuclear Theory Program Director
- Alfredo Galindo-Uribarri – Expt’l Nuclear Physics Program Director
- Allena Opper – Expt’l Nuclear Physics Program Director

https://beta.nsf.gov/careers/openings/mps/phy/phy-21-001
www.nsf.gov/careers/rotator
Funding Announcements

PHY Investigator Initiated Research  NSF 21-593

All proposals submitted to the Division of Physics programs must go through this solicitation.

- **Deadlines:** First Tuesday in December for *Experimental & Theoretical Nuclear Physics*
  → December 7, 2021  5 pm in your home institution’s time zone

- Follow instructions that are specific to this solicitation; non-compliant proposals may be returned without review

- Must conform to the NSF Proposal & Award Policies & Procedures Guide (PAPPG)
  - Updated instructions regarding Current and Pending Support and Biographical Sketches of senior personnel

Questions – contact cognizant program director.
Funding Opportunities:
Major Research Instrumentation (MRI)

• Two tracks:
  o Track 1  $100 k < $ from NSF < $1 M; max of 2/university
  o Track 2  $1 M < $ from NSF < $4 M; max of 1/university

• Two types: development and acquisition; “shovel ready”

• Deadlines & details
  o January 1 – January 19, annually (a window of opportunity)
  o Contact your program directors well ahead of time to discuss & avoid pitfalls
  o 30% cost share req’d for PhD granting institutions
  o Awards above $1M compete across the entire Foundation
Funding Opportunities (cont): PHY Mid-scale Instrumentation

• Design and Construction or Acquisition of Instrumentation
  o “shovel ready”
  o R & early D, operations *funded by research programs*
• ~ $4M < TPC < ~ $20M; over multiple years
• Selection based on
  o merit review
  o exceptional opportunity
  o research community priorities.
• Currently 3 ENP Midscale projects (nEDM, LEGEND-200, MOLLER)
• For more info, see PHY Solicitation & talk with PHY program directors
PHY DCL: Growing a Strong, Diverse Workforce  NSF 21-065

PHY-GR Supplements – emphasis on URMs in STEM fields
• Graduate Student Eligibility
  o Not currently supported by federal government (NSF, DOE, NIH, ...)
  o US Citizen, US National, or US Permanent Resident
• Stipend, tuition, benefits, and IDC (~$60k)
• Renewable up to two times, no deadline for submission however, early submission suggested

REU Supplements – emphasis on URMs in STEM fields
• US Citizen, US National, or US Permanent Resident
LEAPS and ASCEND

LEAPS: Launching Early-Career Academic Pathways in MPS NSF 22-503
• Designed to launch careers of pre-tenure faculty in MPS fields, emphasis on minority-serving institutions (MSIs), predominantly undergraduate institutions (PUIs), and Carnegie Research 2 (R2) universities with the goal of achieving excellence through diversity
• Due date = 07-jan-2022

Awards = 24 months, up to $250k

ASCEND - Postdoctoral Research Fellowships NSF 22-501
• Goal: to support Postdoctoral Fellows who will broaden the participation of groups that are underrepresented in Mathematical and Physical Sciences (MPS) fields in the U.S.
• And to prepare PD Fellows to transition from a postdoctoral position into the first few years of an academic faculty position
• Fellowships are awards to individuals, not institutions, and are administered by the Fellows
• Due date = 06-jan-2022

$100k/year for up to 3 years
• Enhance fundamental research and development;
• Address racial equity in science and engineering;
• Address climate science and sustainability research;
• Strengthen U.S. leadership in emerging technologies; and
• Construct additional major research facilities.
FY22 Budget Proposals – NSF
$ in ( ) = FY21 estimates

- NSF Total ($8.49 B)
  - President’s Request: 14%
  - House Bill: 12%
  - Senate Bill: 20%

- Research & Related Activities ($6.88 B)*
  - President’s Request: 12%
  - House Bill: 12%
  - Senate Bill: 11%

- Education & Human Resources ($1.11 B)*
  - President’s Request: 16%
  - House Bill: 16%
  - Senate Bill: 15%

- Major Research Equipment & Facilities Construction ($0.24 B)
  - President’s Request: -1%
  - House Bill: 3%
  - Senate Bill: 3%

- Agency Operations & Award Management ($0.37 B)
  - President’s Request: 4%
  - House Bill: 4%
  - Senate Bill: 19%

* Figures account for consolidation of the Graduate Research Fellowship Program budget in the EHR directorate.
### FY22 President’s Budget Request ($M) – Education and Human Resource Directorate BP Programs

<table>
<thead>
<tr>
<th>Broadening Participation: Focused Programs</th>
<th>FY 2020 Actual</th>
<th>FY 2021 Estimate</th>
<th>FY 2022 Request</th>
<th>Change over FY 2021 Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADVANCE</td>
<td>$18.00</td>
<td>$18.00</td>
<td>$20.50</td>
<td>$2.50 13.9%</td>
</tr>
<tr>
<td>Alliances for Grad Ed &amp; the Professoriate (AGEP)</td>
<td>8.00</td>
<td>8.00</td>
<td>12.00</td>
<td>$4.00 50.0%</td>
</tr>
<tr>
<td>Ctrs of Research Excellence in Science &amp; Tech (CREST)</td>
<td>24.00</td>
<td>24.00</td>
<td>39.00</td>
<td>$15.00 62.5%</td>
</tr>
<tr>
<td>Excellence Awards in Science &amp; Engineering (EASE)¹</td>
<td>7.33</td>
<td>5.00</td>
<td>7.64</td>
<td>$2.64 52.8%</td>
</tr>
<tr>
<td>Historically Black Colleges &amp; Universities Undergraduate Program (HBCU-UP)</td>
<td>35.00</td>
<td>36.50</td>
<td>46.50</td>
<td>$10.00 27.4%</td>
</tr>
<tr>
<td>Improving Undergraduate STEM Education: Hispanic Serving Institutions (IUSE:HSI)</td>
<td>45.00</td>
<td>46.50</td>
<td>56.50</td>
<td>$10.00 21.5%</td>
</tr>
<tr>
<td>NSF INCLUDES</td>
<td>20.75</td>
<td>20.00</td>
<td>46.50</td>
<td>$26.50 132.5%</td>
</tr>
<tr>
<td>Louis Stokes Alliances for Minority Participation (LSAMP)</td>
<td>47.49</td>
<td>49.50</td>
<td>69.50</td>
<td>$20.00 40.4%</td>
</tr>
<tr>
<td>NSF Scholarships in STEM (S-STEM)²</td>
<td>79.91</td>
<td>132.75</td>
<td>121.85</td>
<td>-10.90 -8.2%</td>
</tr>
<tr>
<td>Tribal Colleges &amp; Universities Program (TCUP)</td>
<td>15.00</td>
<td>16.50</td>
<td>21.00</td>
<td>$4.50 27.3%</td>
</tr>
<tr>
<td><strong>Subtotal, Focused Programs</strong></td>
<td><strong>$300.48</strong></td>
<td><strong>$356.75</strong></td>
<td><strong>$440.99</strong></td>
<td><strong>$84.24 23.6%</strong></td>
</tr>
</tbody>
</table>
Young Scholars Program @ UIUC

- Six-week summer program for HS students URG & teachers (with stipends)
- Mentoring by GS, PD, and faculty
- Research projects, talks, social time, college prep, capstone poster symposium
- Initiated by UIUC Nuclear Physics Group → expanded to entire college

2021

- Total of 23 students
- Virtual format: pros and cons

Future options

- “Doughnut” model: bring students to campus for first and last (symposium) week
Third and Last GRETINA Campaign at NSCL
GRETINA will return to MSU for early FRIB science

• 2012 – 2020: NSCL hosted GRETINA three times @ S800 spectrograph (NSCL I-III)
• NSCL III finished in FY21: 14 experiments, 2 under COVID safeguards
• So far, >60 papers came out of NSCL I – III with many more to be published (~15 PhD theses completed)

http://gretina.lbl.gov/publications
ReA Stand-Alone Program Running Well

- ReA6 at NSCL is fully operational & ReA Stand-Alone program is underway
- 5 ReA6 experiments completed; experiments with $^{10}$Be and $^{7}$Be
- New experimental equipment in place and working well
  - SOLARIS (ANL) with AT-TPC
  - SOLARIS with Si detector (ANL)
  - General purpose line
- SECAR recoil separator $\rightarrow$ direct measurements of astrophysical $p$- and $\alpha$-capture reactions at NSCL and FRIB
  - Completed September 2021 on budget and within schedule
EOS Symmetry Energy: Neutron Stars, PV, Mirror Pair Charge Radii

- Nuclear Matter EOS $\rightarrow$ nuclei structure & stability, nucleosynthesis, NS structure
- For $\infty$ NM, EOS $= \frac{E}{A} - M = \varepsilon_{\text{SNM}}(\rho) + \alpha^2 S(\rho)$
  - $S(\rho) = \text{“symmetry energy”},$ with $\rho$ dependence = L
- Pressure of n matter $\rightarrow$ neutrons outward against surface tension
  - Affects NS Radius: NICER + LIGO $\rightarrow$ $10 \sim L \sim 55$ MeV
  - n-skin $(R_n - R_p)$ of nuclei (see below)
- PREX @ JLab: elastic e + $^{208}\text{Pb} \rightarrow A_{PV} \rightarrow R_w \rightarrow \Delta R_{np} \rightarrow L$
- $\Delta R_{np} = R_{ch}(^A z X_N) - R_{ch}(^A N Y_Z) = \Delta R_{ch} \sim |N - Z| \times L$
  - BECOLA @ NSCL:
    - $^{54}\text{Ni}$ beam cooled, trapped, co-linear spectroscopy
      $\rightarrow R_{ch}(^{54}\text{Ni}) [Z = 28, N = 26]$
    - Compare w/$R_{ch}(^{54}\text{Fe}) [Z = 26, N = 28] \rightarrow \Delta R_{ch} = 0.049(4)$ fm
    - $21 < L < 88$ MeV; somewhat softer than PREX

Improved measurement of free n lifetime

- Free neutron lifetime $\rightarrow$ weak interaction rates
  - Primordial element formation
    - $\tau_n$ dominates theoretical uncertainty of $^4$He abundance
  - Astronomy: solar cycle, NS formation
  - Electroweak physics
Improved measurement of free $n$ lifetime

- Free neutron lifetime $\rightarrow$ weak interaction rates
Improved measurement of free n lifetime

\[ \tau_n = 877.75 \pm 0.28 \text{ (stat)} +0.22/-0.16 \text{ (sys)} \text{ s} \]
Improved measurement of free $n$ lifetime

New result

\[ \tau_n = 877.75 \pm 0.28 \text{ (stat)} +0.22/-0.16 \text{ (sys)} \text{ s} \]
For the latest updates: https://www.nsf.gov/physics

Contact us at:
• bmihaila@nsf.gov or call (703)292-8235
• agalindo@nsf.gov or call (703)292-5139
• aopper@nsf.gov or call (703)292-8958