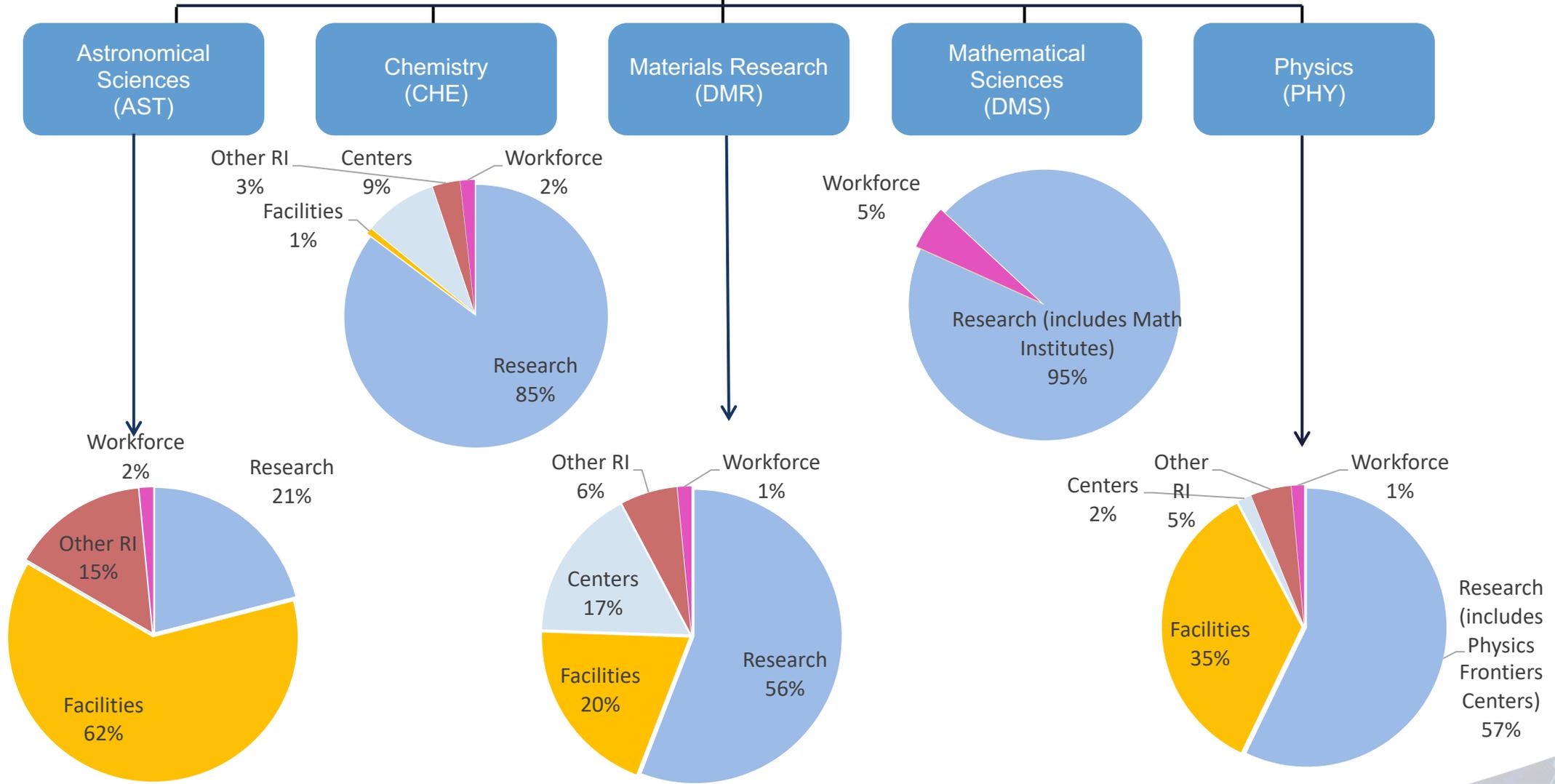




# NSF Mathematical and Physical Sciences

C. Denise Caldwell  
Division Director, Division of Physics  
HEPAP, November 2021

# Mathematical and Physical Sciences (MPS)



Source: FY 2018 Actuals Data

# Welcome new Staff

MPS Directorate:

Debra Fischer – DD for AST

Physics Division:

Jim Shank, Program Director for Elementary Particle Physics program – replacing Saul Gonzalez

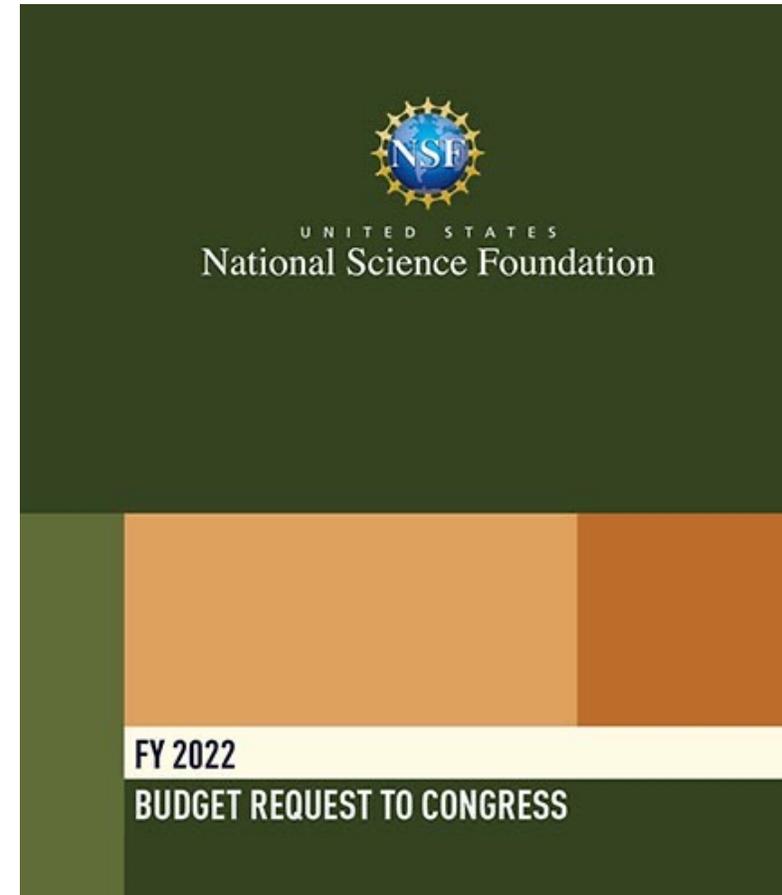
Darren Grant, Program Director (IPA) for Particle Astrophysics

William Wester, Program Director (Visiting Scientist) for Particle Astrophysics - replacing Jim Whitmore



# FY 2022 Budget

- Currently under CR through Dec. 3
- NSF Budget Request: \$10.17 billion
  - \$1.68 billion over FY2021 Enacted
  - House (\$9.63 billion)
  - Senate (\$9.49 billion)
- MPS budget request of \$1.69 billion
  - \$0.11 billion over FY2021 Enacted



# NSF'S MISSION

To promote the progress of science; to advance the national health, prosperity, and welfare; and to secure the national defense.



## Director's Vision



Advance the frontiers of research into the future



Ensure accessibility and inclusivity



Secure global leadership

We are in a **DEFINING MOMENT**



Intensity of global competition



Urgent need for domestic talent



Broad support for science as path for solving global grand challenges

We can accomplish this vision with:

## SPEED AND SCALE



PEOPLE



PARTNERSHIPS



TRANSLATION



# NSF COVID Response

## Identified Areas of Need

### Most Strongly Affected Groups

 MSIs, Less Affluent Institutions

 Women Researchers

 Underrepresented Groups

 Early-career Faculty

 Post-docs, Trainees, Fellows

### Vulnerable Transition Points

 Undergraduate Students

 Graduate Students

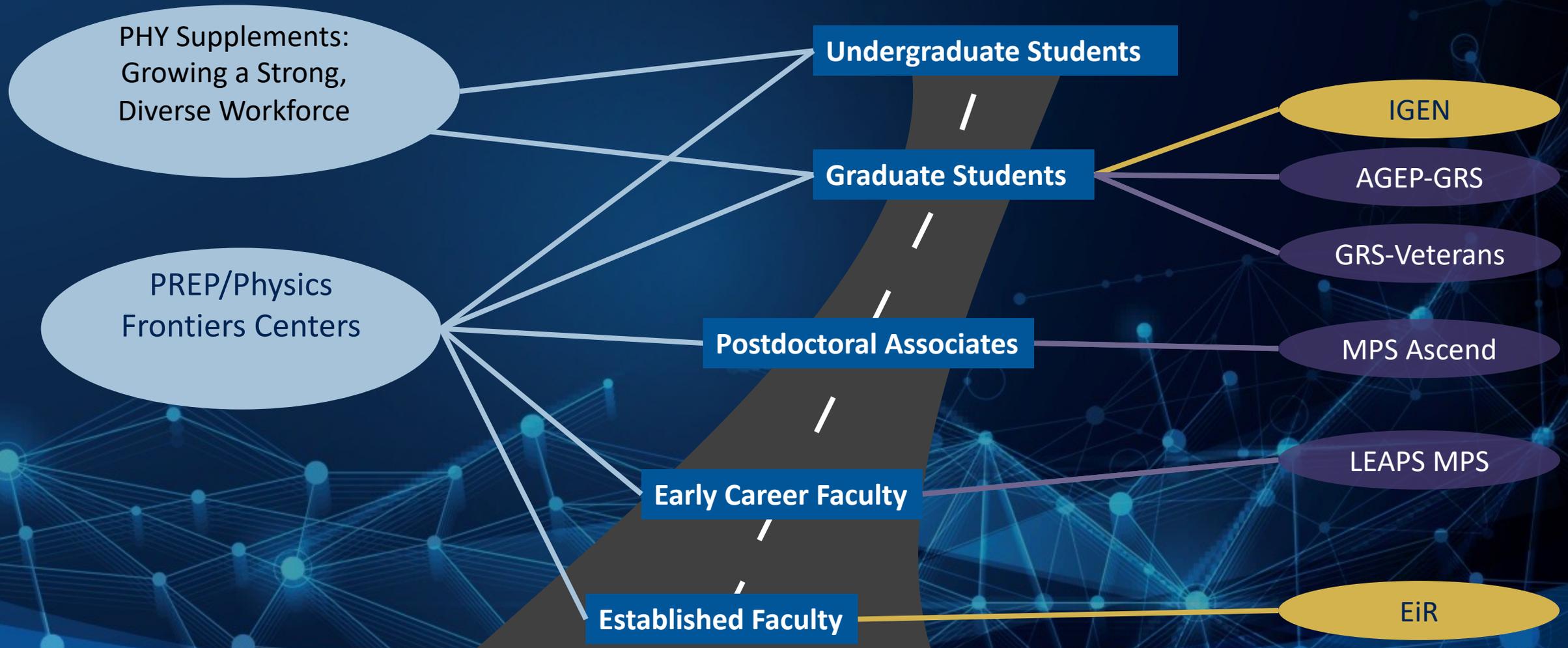
 Post-docs, Trainees, Fellows

 Early-career Faculty

 Mid-career Faculty



# PHY invests in people throughout the STEM pathway via PHY-specific MPS-wide, NSF-wide and initiatives



# MPS Facilities – Operations and Construction Status

- All Facilities operational, under COVID protocol
  - Vaccination mandates may have staffing impacts
- LHC – Both operations and HL-LHC construction proceeding well (Details from Jim Shank)
- IceCube upgrade on hold due to difficulties in South Pole access
- NSCL transfer to FRIB proceeding smoothly
- DKIST on schedule for transition to operations in late November 2021
  - All six instruments have completed site acceptance tests, and five out of six have collected on-sky Science Verification data
- Rubin Observatory re-baseline underway
  - Expect COVID delay of >16 months at cost of >\$60M
  - Project teams back on site, making excellent progress (now ~90% complete)



# LIGO – Virgo

## News and Upgrades



LIGO is now preparing for a fourth observing run, possibly as early as June 2022, depending on COVID impacts on the schedule. Detector improvements now being implemented are expected to improve sensitivity by at least 25%.

LIGO continues the development of the upgrade known as A+, funded by NSF, UKRI and ARC in 2018. A+ is expected to be fully operational by 2024, increasing Advanced LIGO sensitivity by 70%.



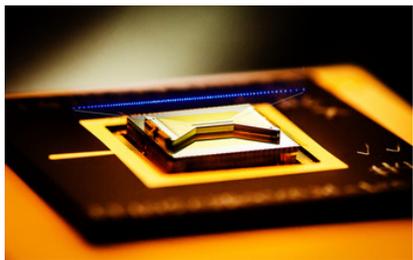
*An illustration of the underground KAGRA gravitational-wave detector in Japan. [Image credit: ICRR, Univ. of Tokyo.]*



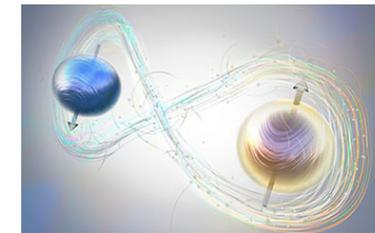
# Quantum Awards FY21

- Quantum Challenge Institutes, 2 awards this year, \$50 Million total
  - NSF Quantum Leap Challenge Institute for Quantum Sensing in Biophysics and Bioengineering
  - NSF Quantum Leap Challenge Institute for Robust Quantum Simulation
- Quantum TAQS, 10 awards, \$24,962,455 total
  - Quantum Interconnect Challenges for Transformational Advances in Quantum Systems
  - Interdisciplinary teams to conduct transformative research that develops and applies quantum science, quantum computing, and quantum engineering in the specific area of quantum interconnects





# Quantum Information Science and Engineering Current Status Overview



**Strong disciplinary programs** in MPS/CHE,DMR,DMS,PHY; CISE/CCF; ENG/ECCS + **Centers** (PFC, STC, MRSEC)

**Quantum Leap Challenge Institutes:** 5 awards; cover four subareas of QIS plus one in BIO

**Quantum Foundries:** 2 Q-AMASE-I awards; UC Santa Barbara and Montana State/U Arkansas

**Translational Advances in Quantum Systems (TAQS) Series:** QII-TAQS 19 awards; QuIC-TAQS 10 awards

**Computer:** 2 awards; PFCQC: STAQ, Duke U; EPIQC, U Chicago

**Network:** Engineering Research Center for Quantum Networks; U Arizona

**Convergence Accelerator:** Track C; Quantum Technology: 4 phase-II awards

**Workforce:** Triplets; Faculty Fellowships; Q-12 Education Partnership



# Biden Administration



**Clean Energy**



**Climate Change**



**Racial Equity**



**Emerging Industries**

