



U.S. National Science Foundation

Dr. Tie Luo, NSF-MPS Directorate Head
Directorate for Mathematical and Physical Sciences
March 24, 2026



HISTORY

An independent federal agency created by Congress in 1950
by the National Science Foundation Act of 1950.

The only federal agency whose mission includes support for research
and education in all fields of fundamental science and engineering.

MISSION



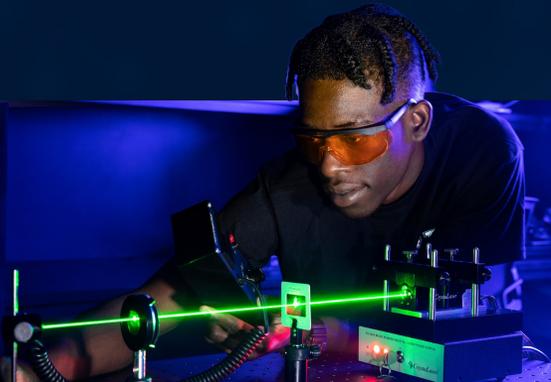
PROMOTE
the progress of science



ADVANCE
the national health, prosperity, and welfare



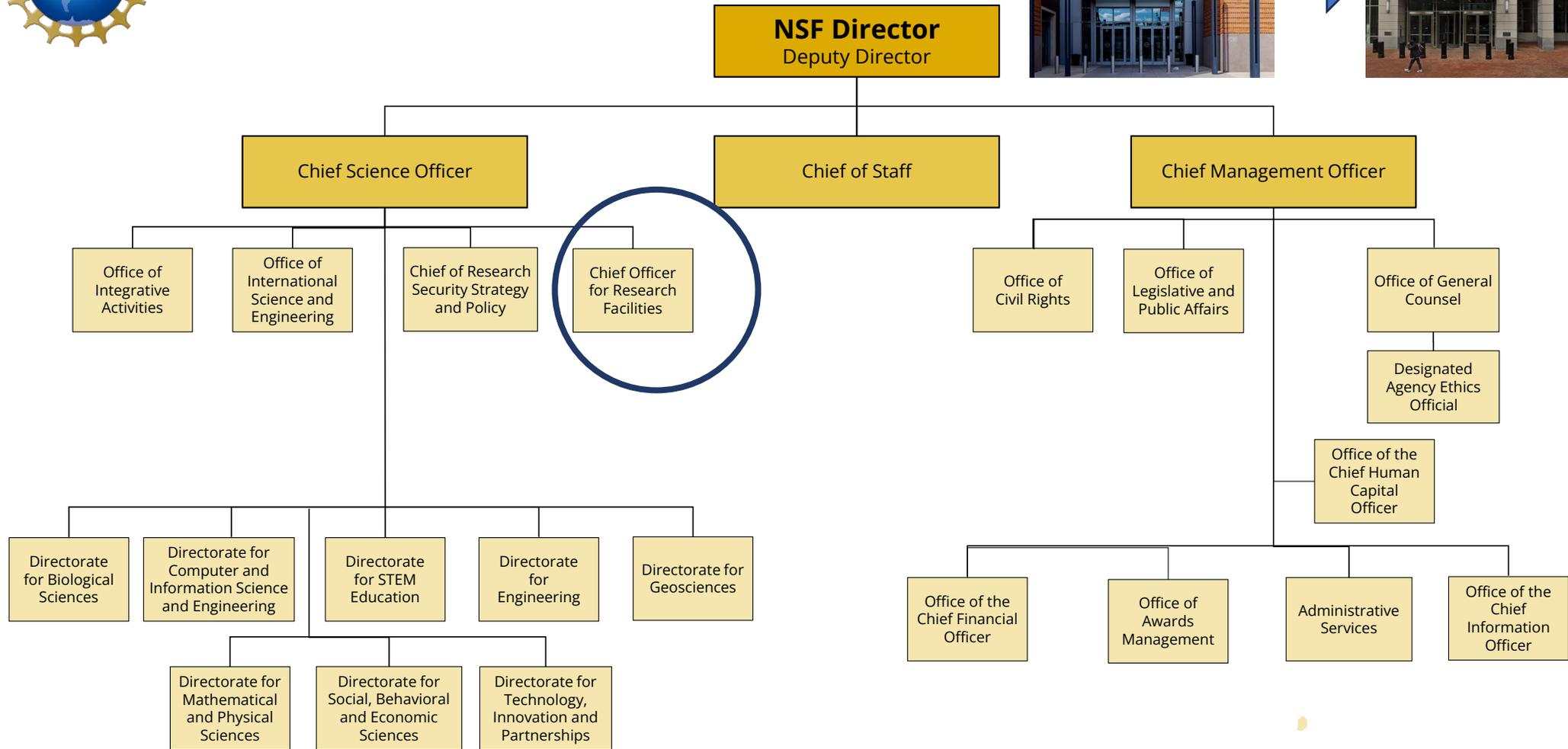
SECURE
the national defense





U.S. National Science Foundation

12/14/2025 organizational structure



NSF supports all areas of science including:



Biological Sciences (NSF BIO)



Mathematical and
Physical Sciences (NSF MPS)



Computing and Information Science
And Engineering (NSF CISE)



Social, Behavioral and
Economic Sciences (NSF SBE)



Engineering (NSF ENG)



STEM Education (NSF EDU)



Geosciences (NSF GEO)

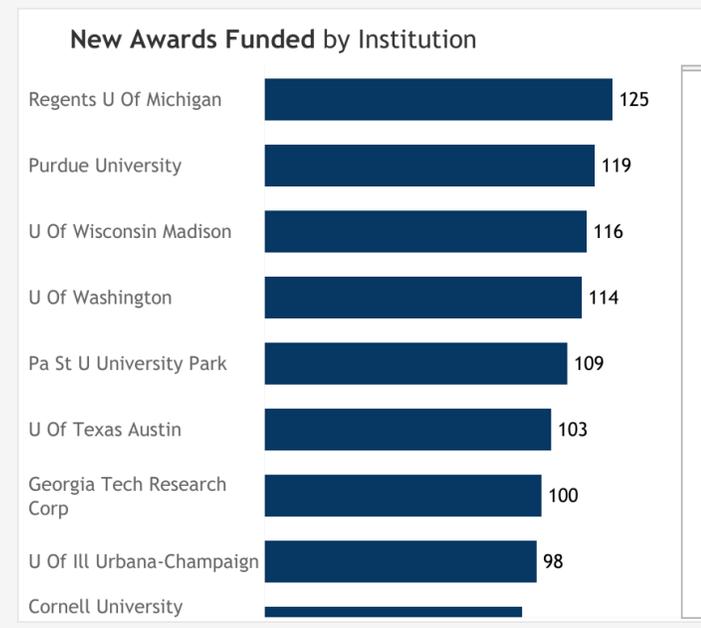
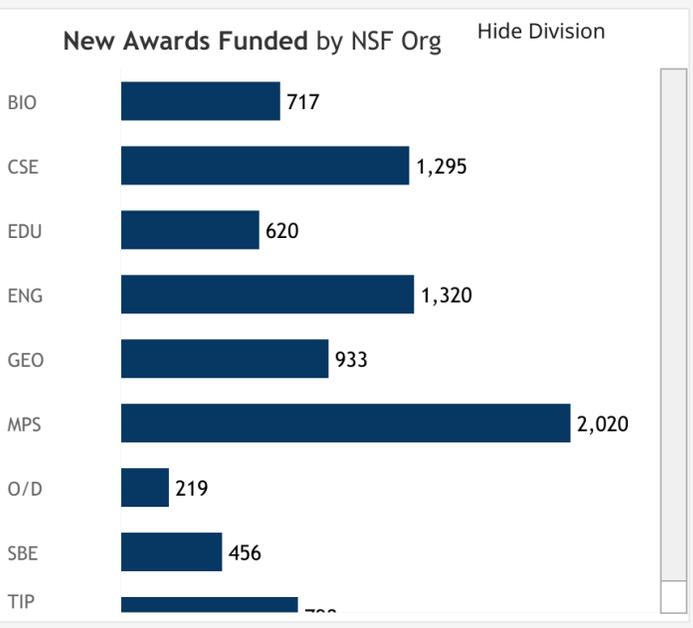
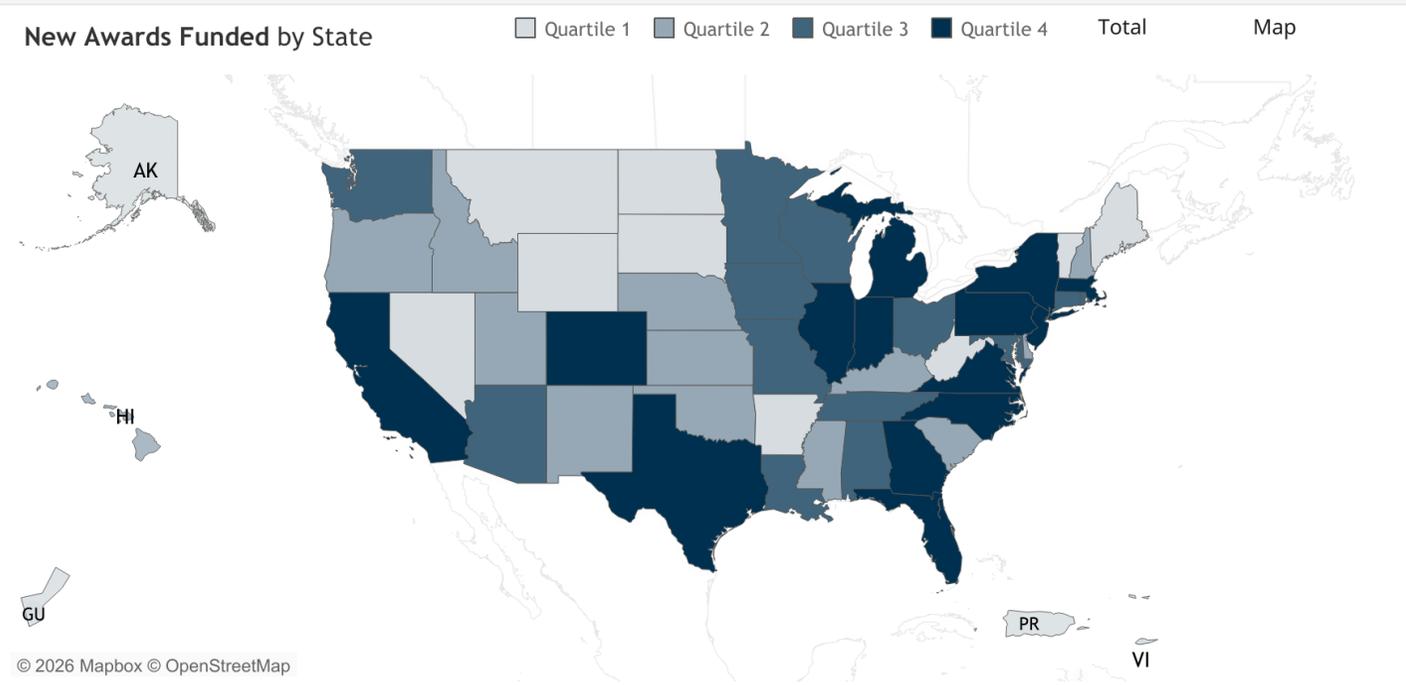
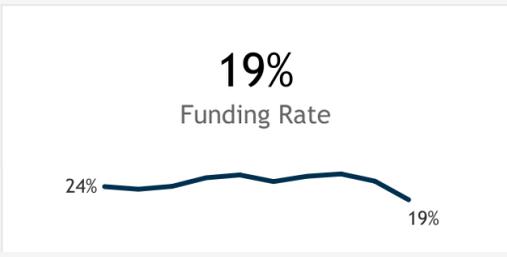


Technology, Innovation
and Partnerships (NSF TIP)

Competitive Advantage

NSF reaches into every state and
territory to support all areas of science
and engineering

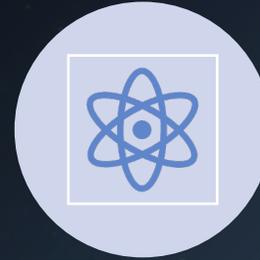
NSF by the Numbers



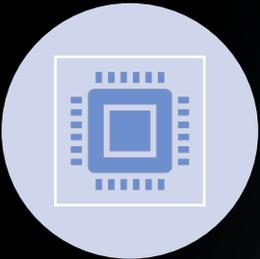
ADMINISTRATION AND NSF PRIORITIES



Artificial Intelligence



Quantum Information
Science and Technology



Advanced Manufacturing,
Microelectronics/
Semiconductors

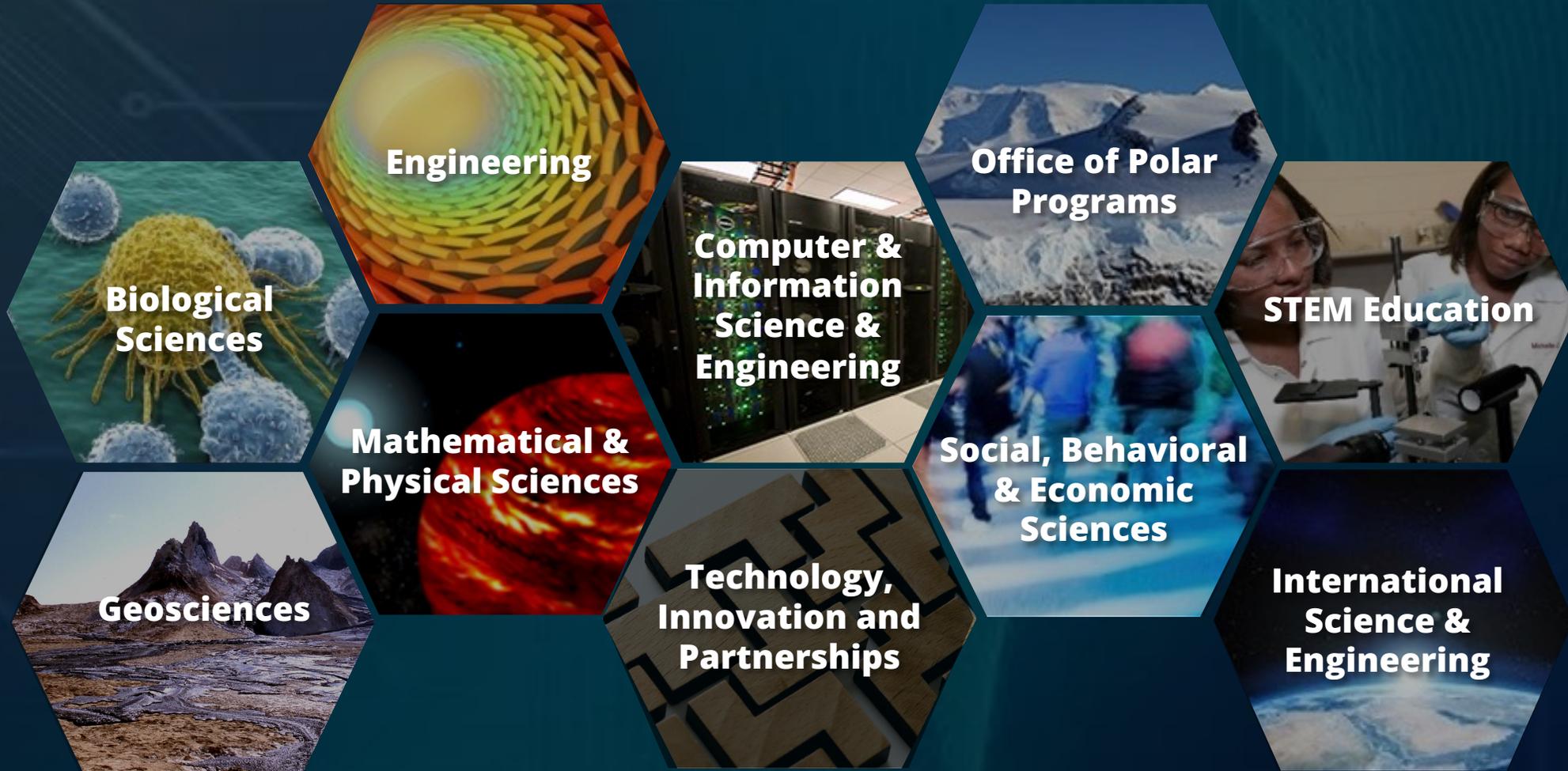


Biotechnology

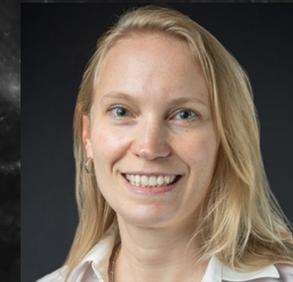


Increased Investment in
EPSCoR Jurisdictions

Primary Touchpoints with Space Science



NSF-Simons AI Institute for Cosmic Origins (CosmicAI)



PI: Stella Offner
University of Texas

★ Lead Institutions

- University of Texas, Austin
- University of Virginia
- University of Utah
- University of California, Los Angeles
- New York University
- NRAO
- NOIRLab

★ Academic Partners & Labs

- SLAC National Accelerator Laboratory
- University of Texas Arlington
- University of Tennessee

○ Industry Partners

- AI2
- Microsoft
- Intel
- NVIDIA
- Sony AI
- Amazon
- SparkCognition



The **NSF-Simons AI Institute for Cosmic Origins (CosmicAI)** is a collaborative powerhouse funded by the U.S. National Science Foundation and the Simons Foundation. It unites elite researchers from institutions including **UT Austin, UVA, Utah, NSF NRAO, NSF NOIRLab, UCLA, and NYU.**

By blending expertise across disciplines—from Physics and Chemistry to Computer Science and Statistics—the institute develops cutting-edge AI to investigate the origins of our universe. Their research is anchored in four essential AI pillars: **trustworthiness, efficiency, interpretability, and robustness**, while their mission emphasizes democratizing science through open-source tools and educational initiatives.

NSF-Simons AI Institute for the Sky (SkAI)



PI: Vicky Kalogera
Northwestern University

Lead Institutions:

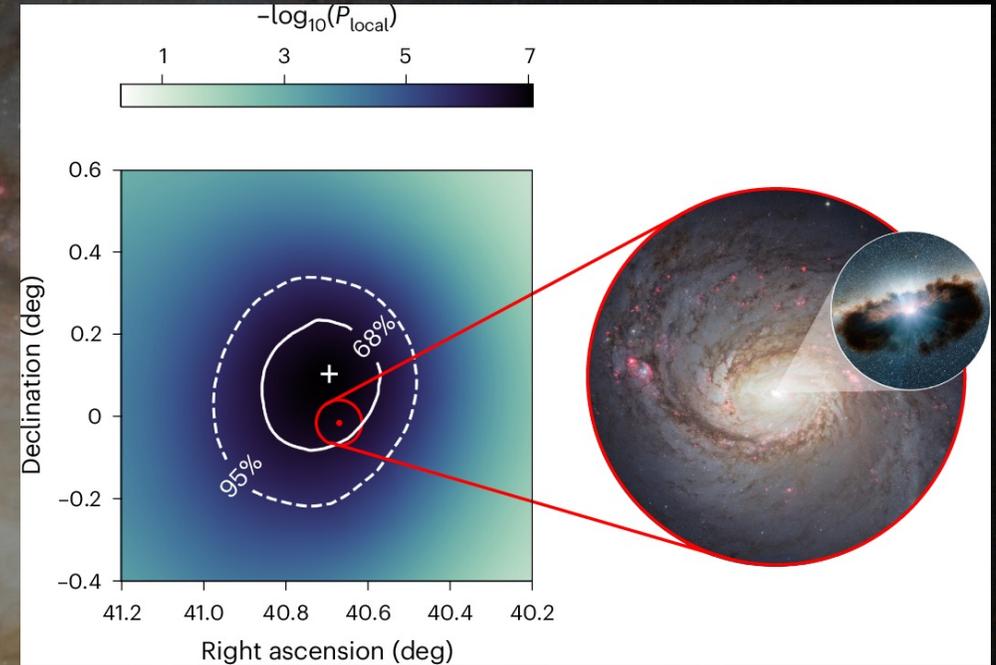
Northwestern University
University of Chicago
University of Illinois at Urbana-Champaign



SkAI is cultivating a dynamic, cross-disciplinary community that unites the worlds of astronomy and AI. By integrating hybrid events, digital outreach, and the physical SkAI Hub (launched in June 2025), the organization facilitates global innovation. To date, this network supports members across **108 institutions in 17 countries**, providing a dedicated space for hackathons and collaborative research.

NSF IceCube Neutrino Observatory

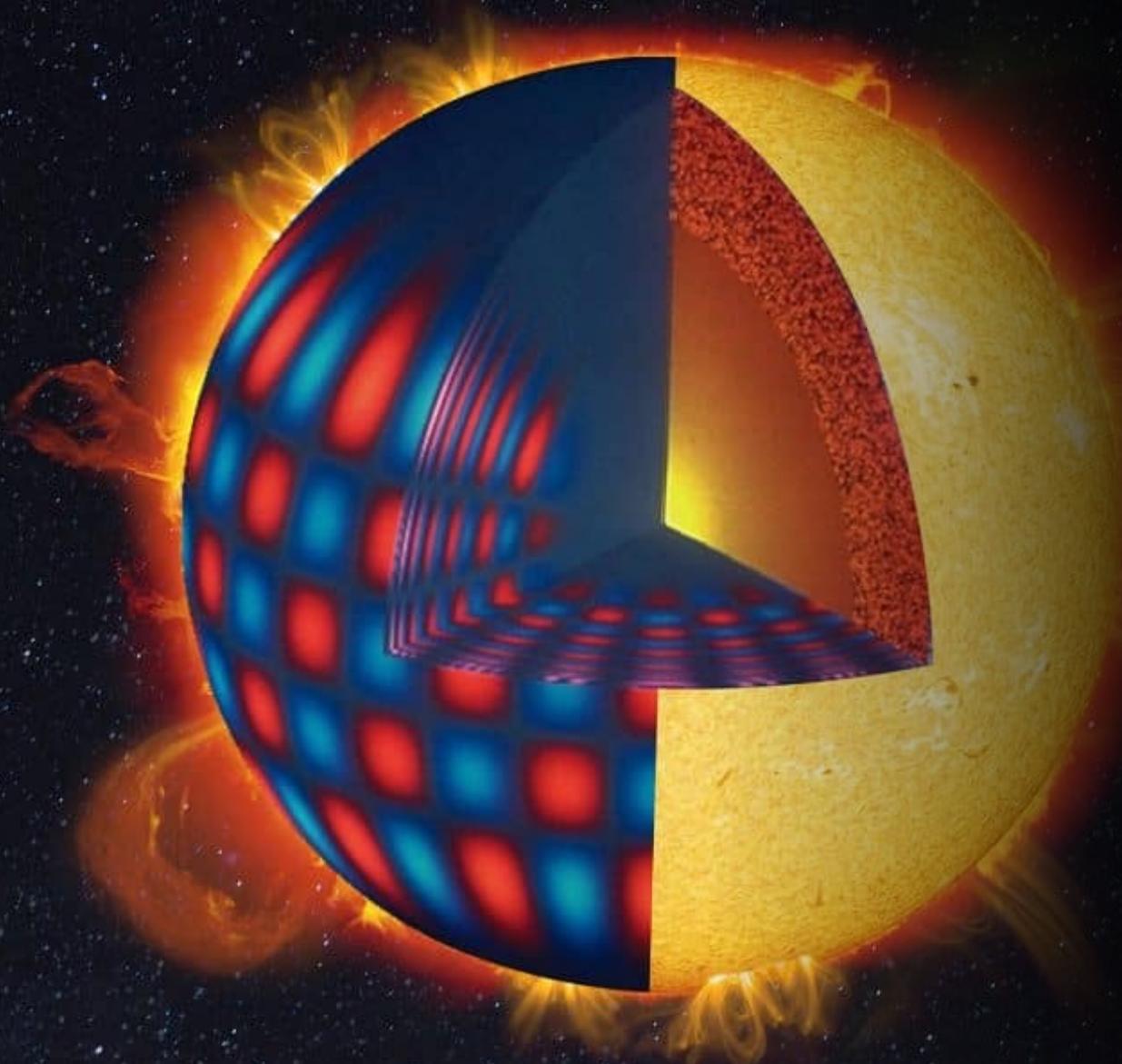
- 1 cubic kilometer of instrumented clear ice beneath the South Pole to study the higher energy neutrinos from the cosmos
- NSF IceCube successfully deployed 6 new strings as part of the Upgrade program in Winter 2026
- NSF IceCube is commissioning the upgraded detector and expect to be operational in Summer 2026



In 2025, NSF IceCube announced evidence for high-energy neutrinos from a nearby active galaxy nucleus, NGC 1068, with a central massive black hole.

NSF IceCube is opening a window to the universe through the observation of sources of high energy neutrinos





NSF National Solar Observatory (NSO)

The GONG Legacy: Celebrating **30+ years** of continuous, 24/7 solar monitoring since its launch in 1995.

Next-Gen Network (ngGONG) Awarded: In **September 2025**, the NSF awarded **\$19 million** to design a state-of-the-art successor for superior space weather forecasting.

"Clear" Adaptive Optics Breakthrough: As of **May 2025**, new multi-mirror technology provides the sharpest wide-field views of the Sun's atmosphere ever captured from Earth.

Mission Critical: Modernizing infrastructure to protect satellites, power grids, and communication from solar eruptions.

Solving the Solar Gamma-Ray Mystery

Supported by the NSF Directorate for Geosciences (GEO)

The Problem: For 70 years, the exact source of intense gamma rays—the universe's highest-energy radiation—emitted during solar flares remained a mystery.

The Discovery: Researchers identified a "hidden" population of **MeV-peaked electrons** in the Sun's corona that act as the primary engine for these bursts.

The Technology: Discovery made by syncing NASA's **Fermi Telescope** with the **NSF-funded Expanded Owens Valley Solar Array (EOVSA)**.

The Impact: New insights into *bremsstrahlung* (braking radiation) allow for more **accurate space weather forecasting** to protect Earth's power grids and satellites.



Earth to Scale

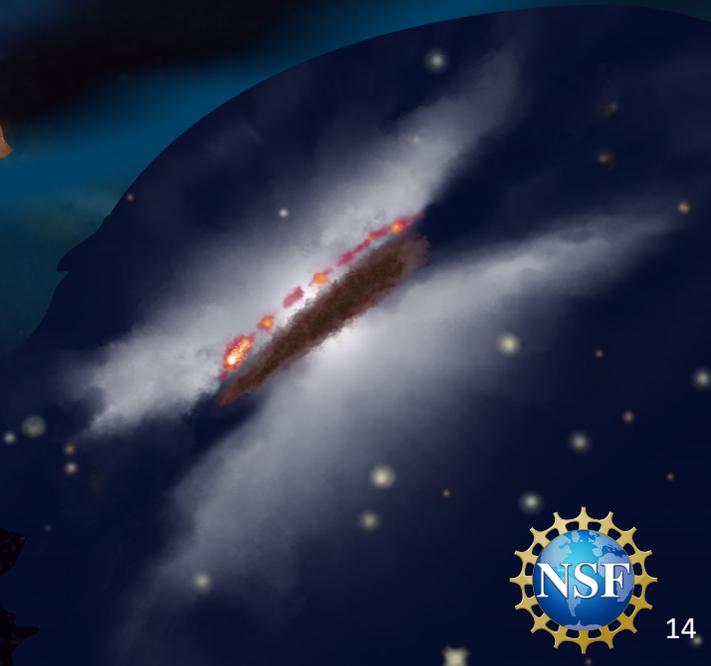
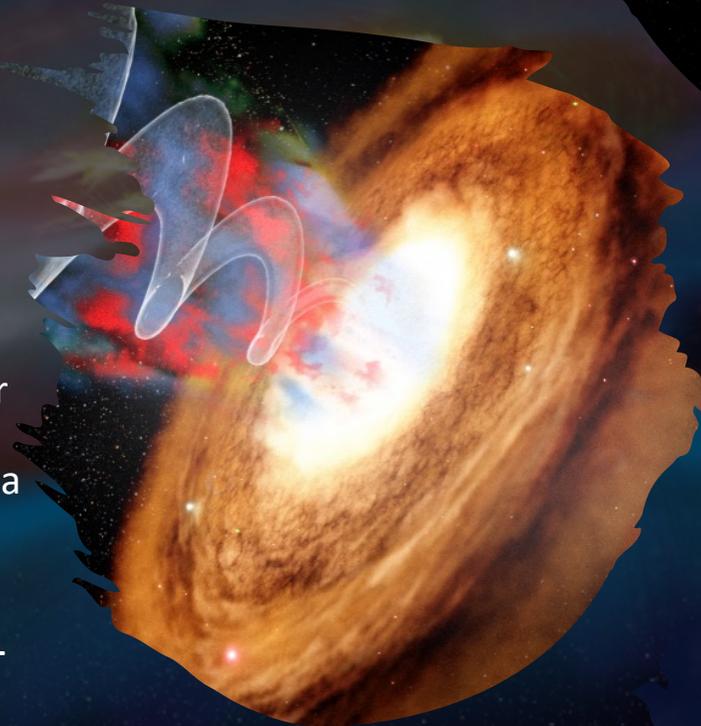
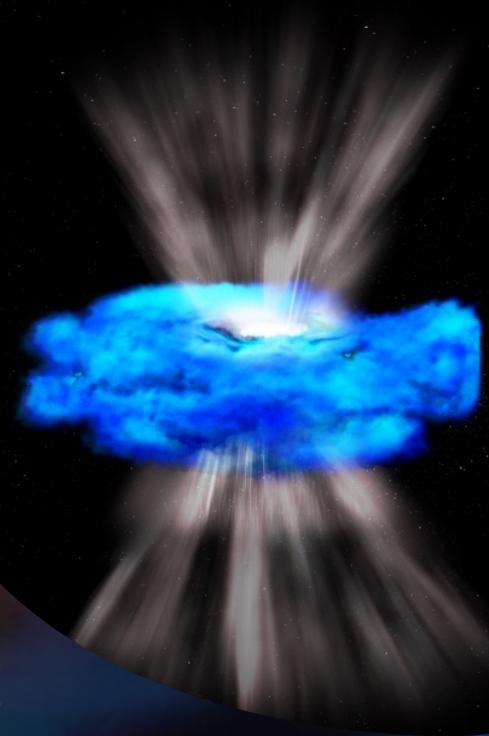
NSF National Radio Astronomy Observatory

Planet Birth: ALMA reveals a "Cosmic Hamburger" (the HH 212 protostellar disk), detecting organic molecules and dust structures that signal the **earliest stages of giant planet formation**.

Stellar Death: The VLA achieved the **first radio detection of a Type Ibn supernova**, uncovering the hidden environment of a massive star just before it collapsed and exploded.

Ultrafast Physics: VLA observations of the Crab Pulsar captured the **fastest-evolving radio signals ever recorded**, with "microshots" lasting only billionths of a second.

Galactic Evolution: Astronomers discovered a **record-breaking stream of super-heated gas** (250,000 light-years long) being stripped from a galaxy, revealing how galaxies "lose their breath" and stop forming stars.



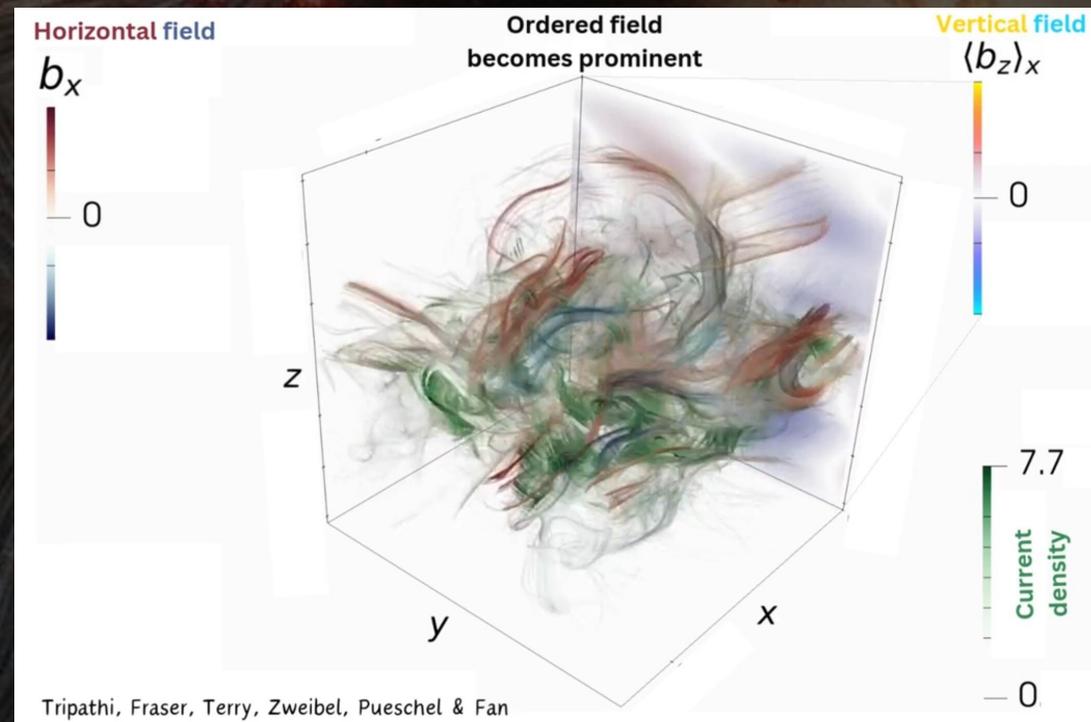
Science Highlight: Velocity gradients key to explaining large-scale magnetic field structure

Published in *Nature*, Researchers at the University of Wisconsin–Madison have identified a breakthrough mechanism that explains how large-scale, organized magnetic fields emerge from chaotic, turbulent plasma.

Discovery: Turbulent plasma organizes into structured magnetic fields via **steady velocity gradients**.

Method: Massive 3D simulations (137 billion grid points).

Impact: Resolves a 70-year mystery; improves predictions for solar flares and galaxy dynamics.



Accelerating High-Impact Ventures through SBIR/STTR Programs

The **NSF Directorate for Technology, Innovation and Partnerships (TIP)** utilizes SBIR/STTR programs to fund transformative technologies, reshaping how we power, test, and deploy space systems.

Xona Space Systems (Next-Gen Navigation):

- Developing an advanced satellite-based PNT (Positioning, Navigation, and Timing) system.
- **2025 Milestone:** Successfully launched the **Pulsar-0 satellite** and raised **\$92M** in follow-on investment.
- **Defense Priority:** Supported by the USAF to provide a more secure, jam-resistant alternative to traditional GPS.

Credit: Xona Space Systems



ISS National Laboratory : Enabling More Efficient Power Generation

Funding & Support: Sponsored by the **U.S. National Science Foundation Engineering Directorate (ENG)** through the NSF-CASIS joint solicitation.

Leading Institution: University of California, Santa Barbara (UCSB).

The Science: Solving the Microgravity Fluid Crisis

- **The Problem:** In space, bubbles don't rise (no buoyancy); they "stick" to surfaces, creating an insulating layer that causes systems to overheat.
- **The Breakthrough:** Researchers used **light-sensitive molecules** to manipulate surface tension—a phenomenon known as the **Marangoni Effect**.
- **The Result:** For the first time, light was used to "steer" bubbles and fluids in microgravity without the need for heavy, energy-intensive mechanical pumps.



NSF CMB Portfolio 2026

South Pole

South Pole Telescope w/3G+ camera



BICEP Array

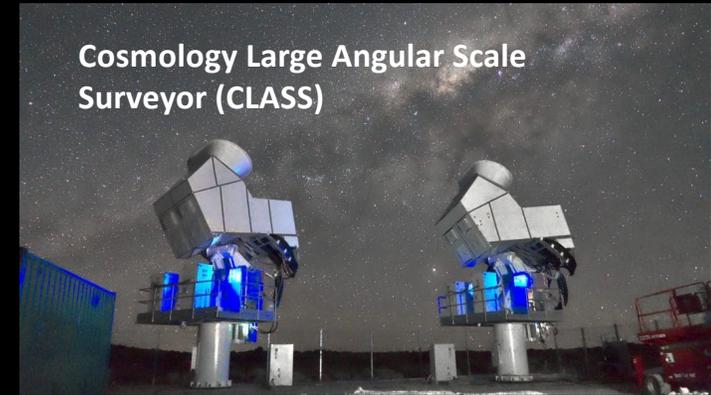


Chilean Atacama

Advanced Simons
Observatory



Cosmology Large Angular Scale
Surveyor (CLASS)



NSF and DOE CMB Science

NSF has over **25 years** of world leadership in CMB science, including technology development & deployment, and continued survey operations

- **NSF/DOE have regular discussions between agencies and with current projects**
- **Upgrade current experiments as planned and funded**
- **CMB-S4 was transformative when proposed but other experiments have made significant progress since that time (including ones by members of the CMB-S4 team)**
- **Three of the four major CMB-S4 science goals achievable, fourth goal, inflation science, reachable within a factor of ~ 2 , maybe better**
- **CMB-S4 decision was based on cost-benefit for reaching science goals**

