

MPS Funding
(Dollars in Millions)

	FY 2023	FY 2024 (TBD)	FY 2025 Request	Change over	
	Base Plan ¹			FY 2023 Base Plan Amount	Percent
Astronomical Sciences (AST)	\$288.21	-	\$318.53	\$30.32	10.5%
Chemistry (CHE)	264.99	-	264.99	-	-
Materials Research (DMR)	334.50	-	345.72	11.22	3.4%
Mathematical Sciences (DMS)	248.40	-	248.40	-	-
Physics (PHY)	308.65	-	312.90	4.25	1.4%
Office of Strategic Initiatives (OSI)	215.20	-	191.09	-24.11	-11.2%
Total	\$1,659.95	-	\$1,681.63	\$21.68	1.3%

¹ For comparability with FY 2025, the FY 2023 levels do not include this organization’s share of Mission Support Services that were funded through the R&RA and EDU directorates and offices.

About MPS

Research in the foundational physical sciences is the central theme of projects supported by MPS. The core areas of astronomical sciences, chemistry, materials research, mathematical sciences, and physics continue to advance and transform knowledge and support the development of the next generation of scientists. Sciences funded by MPS encompass an enormous range: from the smallest objects and shortest timescales studied to distances and timescales that are the size and age of the universe. MPS continues to foster and support interdisciplinary scientific programs that span in scope and complexity, ranging from individual investigator awards to large, multi-user facilities. Individual investigators and small teams receive most awards, but centers, institutes, and facilities are all integral and essential to MPS-funded research. This convergence of disciplines and various ways to organize researchers allows MPS to invest in advancing basic sciences that will underpin and enable innovations in the technologies of the future and help to support a strong U.S. economy for decades to come.

Through its centers and institutes programs, MPS will continue to support leading-edge science research and the development of the next generation of scientists engaged in research ranging from fundamental to translational science. MPS centers and institutes span a broad range of areas, from addressing challenges in fundamental mathematics to the development of advanced new materials.

Research tools and infrastructure are key priorities that MPS will continue funding. Mid-scale research infrastructure in astronomical sciences, chemistry, materials research, and physics continue to be important to the advancement of those disciplines. Large scale research infrastructure is also highly important and provides opportunities for partnerships with international entities, other federal agencies, and private foundations, as is evidenced by facilities such as the Atacama Large Millimeter/submillimeter Array, the Gemini Observatory, the Large Hadron Collider (LHC), and the National High Magnetic Field Laboratory. Construction activities to upgrade the two primary LHC detectors, A Toroidal LHC Apparatus and the Compact Muon Solenoid, are ongoing in preparation for

high luminosity operation of the LHC to advance our understanding of some of the most fundamental questions in particle physics. Scheduled to transition from construction to full operations in 2025, the Vera C. Rubin Observatory Project on the summit of Cerro Pachón in Chile will produce the widest-field sky images ever with a state-of-the-art data management system and the largest digital camera ever constructed.

The MPS directorate's Request builds on past efforts and aligns with NSF's FY 2025 priorities. Funding supports exciting emerging opportunities, maturing research efforts, and established programs and activities that continue to meet important goals in supporting science that will transform the nation's future. The requested funding will enable MPS to sustain core research programs and support the highest priority centers, institutes, early-career investigators, and facilities including the design and development of future major facilities. MPS will enhance its investments in advancing critical and emerging technology areas including quantum information science and engineering, advanced materials, biotechnology, microelectronics, and artificial intelligence. Additionally, MPS will increase support for clean energy technology and climate research, as well as support to promote equity and broadening participation in STEM research.

In FY 2025, MPS will continue support of the existing Quantum Leap Challenge Institutes and the Expanding Capacity in Quantum Information Science and Engineering program, which increases research capacity, broadens participation in QISE, and enriches the talent and diversity in the workforce pipeline to help fulfill the needs of industry, government, and academia. In collaboration with the TIP directorate, MPS will ramp up support of the National Quantum Virtual Laboratory (NQVL) as an overarching infrastructure platform designed to facilitate the translation of basic science and engineering to innovative technologies, while at the same time emphasizing and advancing the scientific and technical value of the research.

Strengthening its investment under the theme of AI for Sciences and the Science of AI, MPS will add, jointly with CISE Directorate and Intel, another AI Institute for Discovery in Materials Research in FY 2025 to its AI Institute portfolio. Working with other federal agencies, MPS will initiate research programs to investigate theoretical underpinnings of Digital Twins.

MPS will grow the MPS-Ascend Faculty Catalyst Awards program to facilitate the transition of postdoctoral fellows to tenure track positions. The program will help broaden the participation in MPS fields among members of groups that have been historically excluded and are currently underrepresented. MPS will also increase its investment in broadening participation partnership programs across all five of its research divisions.

Climate change and its impacts clearly represents one of the greatest challenges facing civilization today. MPS will support research in providing scientific modeling tools needed to advance our understanding of the physical basis of climate change and develop mitigation and adaptation solutions. MPS-supported research will also significantly contribute to innovation in clean and sustainable energy resources, creating solutions to problems that fundamentally require new ideas. In collaboration with other directorates and industrial partners, MPS will additionally continue to lead agency-wide efforts in supporting Sustainable Chemistry research.

Major Investments

MPS Major Investments

(Dollars in Millions)

Area of Investment ^{1,2}	FY 2023	FY 2024 (TBD)	FY 2025 Request	Change over	
	Base Plan			FY 2023 Base Plan Amount	Percent
Advanced Manufacturing	\$128.33	-	\$139.50	\$11.17	8.7%
Advanced Wireless Research	17.00	-	17.00	-	-
Artificial Intelligence	75.21	-	78.59	3.38	4.5%
BaRP: Clean Energy Technology	123.83	-	129.40	5.57	4.5%
BaRP: USGCRP	12.00	-	12.54	0.54	4.5%
Biotechnology	62.20	-	67.20	5.00	8.0%
Microelectronics/Semiconductors	31.00	-	35.00	4.00	12.9%
Quantum Information Science	179.00	-	187.83	8.83	4.9%
Secure & Trustworthy Cyberspace	1.25	-	1.25	-	-
Sustainable Chemistry	50.00	-	50.00	-	-

¹ Major investments may have funding overlap and thus should not be summed.

² This table reflects this directorate's support for selected topics. Investment priorities and presentation may differ by organization and so should not be summed across narratives.

To learn more about cross-agency themes and initiatives supported by MPS, including Advanced Manufacturing, Advanced Wireless, Artificial Intelligence, Biotechnology, Climate, Microelectronics/Semiconductors, Quantum Information Science, and Secure and Trustworthy Computing, see individual narratives in the NSF-Wide Investments chapter.

- Quantum Information Science: As steward of this program agency wide, MPS will increase investment in the National Quantum Virtual Laboratory (NQVL) program.
- MPS Postdoctoral Fellowships: Postdoctoral research is a critical stage in preparation for professional careers. MPS will increase investment in the MPS-Ascend Faculty Catalyst Awards program, a fellow-to-faculty component to MPS-Ascend program.
- Sustainable Chemistry: MPS will continue to invest in foundational, use-inspired, and translational research and interdisciplinary approaches that will improve the efficiency with which resources are used to meet human needs for chemical products and materials while reducing use of hazardous substances and the generation of waste.

Centers Programs

MPS Funding for Centers Programs

(Dollars in Millions)

	Division	FY 2023	FY 2024 (TBD)	FY 2025 Request	Change over	
		Base Plan			FY 2023 Base Plan Amount	Percent
Artificial Intelligence Research Institutes	MPS	\$5.00	-	\$7.70	\$2.70	54.0%
Centers for Chemical Innovation	CHE	27.70	-	27.70	-	-
Materials Centers	DMR	56.80	-	60.00	3.20	5.6%
Quantum Leap Challenge Institutes	OSI	21.85	-	17.00	-4.85	-22.2%
STC: STC on Real-Time Functional Imaging	DMR	5.00	-	5.00	-	-
STC: Center for Integration of Modern Optoelectronic Materials on Demand	DMR	5.00	-	5.00	-	-
STC: Center for Complex Particle Systems	DMR	-	-	6.00	6.00	N/A
STC: New Frontiers of Sound Science and Technology Center	DMR	-	-	6.00	6.00	N/A
STC: Center for Bright Beams	PHY	5.00	-	3.32	-1.68	-33.6%
Spectrum Innovation Initiative Center	OSI	5.00	-	5.00	-	-
Total		\$131.35	-	\$142.72	\$11.37	8.7%

For detailed information on individual centers programs, please see the Cross Theme Topics section of the NSF-Wide Investments chapter.

Major Facilities

MPS Funding for Major Facilities

(Dollars in Millions)

	Division	FY 2023	FY 2024 (TBD)	FY 2025 Request	Change over	
		Base Plan			FY 2023 Base Plan Amount	Percent
Green Bank Observatory (GBO) ¹	AST	\$10.83	-	\$9.68	-\$1.15	-10.6%
IceCube Neutrino Observatory (ICNO)	PHY	3.83	-	4.08	0.25	6.5%
Large Hadron Collider (LHC)	PHY	20.50	-	20.50	-	-
Laser Interferometer Gravitational Wave Observatory (LIGO)	PHY	45.00	-	49.00	4.00	8.9%
National High Magnetic Field Laboratory (NHMFL) ¹	DMR	39.91	-	39.13	-0.78	-2.0%
National Radio Astronomy Observatory (NRAO)	AST	93.66	-	96.71	3.05	3.3%
NRAO O&M ^{1,2}		43.03	-	43.00	-0.03	-0.1%
Atacama Large Millimeter Array (ALMA) O&M		50.63	-	53.71	3.08	6.1%
National Solar Observatory (NSO)	AST	26.56	-	34.24	7.68	28.9%
NSO O&M		5.88	-	6.24	0.36	6.1%
Daniel K. Inouye Solar Telescope (DKIST) O&M ¹		20.68	-	28.00	7.32	35.4%
NSF National Optical-Infrared Astronomy Research Laboratory (NOIRLab)	AST	73.57	-	86.40	12.83	17.4%
NOIRLab O&M (Mid-Scale Observatories & Community Science and Data Center) ^{1,3}		28.49	-	24.82	-3.67	-12.9%
Gemini Observatory O&M		22.98	-	25.49	2.51	10.9%
Vera C. Rubin Observatory O&M		22.10	-	36.09	13.99	63.3%
Total		\$313.86	-	\$339.74	\$25.88	8.2%

¹ FY 2023 includes funding for repairs and maintenance beyond regular O&M.

² Includes funding for VLBA (\$3.43 million per year), as well as funding for the ngVLA program office.

³ Includes support for the Windows on the Universe Center for Astronomy Outreach, ongoing activities at the WIYN telescope, and potential future participation in the U.S. Extremely Large Telescope program.

For detailed information on individual facilities, please see the Research Infrastructure section of the NSF-Wide Investments chapter.

MPS Divisions

MPS Division Funding by Category¹

(Dollars in Millions)

	FY 2023			Change over	
	Base Plan	FY 2024 (TBD)	FY 2025 Request	FY 2023 Base Plan Amount	Percent
AST	\$288.21	-	\$318.53	\$30.32	10.5%
Research	68.40	-	78.89	10.49	15.3%
Education	4.60	-	4.60	-	-
Infrastructure	215.21	-	235.04	19.83	9.2%
CHE	\$264.99	-	\$264.99	-	-
Research	251.05	-	251.05	-	-
Education	4.04	-	4.54	0.50	12.4%
Infrastructure	9.90	-	9.40	-0.50	-5.1%
DMR	\$334.50	-	\$345.72	\$11.22	3.4%
Research	282.11	-	275.61	-6.50	-2.3%
Education	3.00	-	3.00	-	-
Infrastructure	49.39	-	67.11	17.72	35.9%
DMS	\$248.40	-	\$248.40	-	-
Research	235.04	-	235.40	0.36	0.2%
Education	13.36	-	13.00	-0.36	-2.7%
PHY	\$308.65	-	\$312.90	\$4.25	1.4%
Research	212.32	-	212.80	0.48	0.2%
Education	5.02	-	5.02	-	-
Infrastructure	91.31	-	95.08	3.77	4.1%
OSI	\$215.20	-	\$191.09	-\$24.11	-11.2%
Research	146.75	-	132.70	-14.05	-9.6%
Education	10.00	-	10.62	0.62	6.2%
Infrastructure	58.45	-	47.77	-10.68	-18.3%

¹ For comparability with FY 2025, the FY 2023 levels do not include this organization's share of Mission Support Services that were funded through the R&RA and EDU directorates and offices.

Division of Astronomical Sciences (AST). AST funds grants for astronomical research and provides access to world-class astronomical observing facilities via cooperative agreements. These observatories enable scientific advances by providing access on a competitive basis to thousands of astronomers each year. AST also supports the development of advanced technologies and instrumentation and manages the electromagnetic spectrum for scientific use by the entire NSF community. The AST portfolio includes research on the nature of planets, stars, galaxies, and the structure of the universe. Through collaboration with the Division of Physics, astrophysicists are able to probe the universe through three distinct “windows”—electromagnetic waves, high-energy particles, and gravitational waves—and across the time domain. This leads to a deeper understanding

of the composition and evolution of the cosmos, including the nature of the mysterious dark matter and dark energy that comprise more than 95 percent of the universe. AST observatories and research programs have enabled the detection of planets orbiting other stars and will support the search for life on these other worlds.

Division of Chemistry (CHE). CHE supports discovery research and workforce development in chemistry that have the potential to be transformative to major commercial sectors of the U.S. economy: energy, pharmaceuticals, medical applications, plastics, electronics, food, agriculture, and transportation. CHE investments also support highly competitive and rapidly evolving fields that include advanced manufacturing, quantum information sciences, data mining and artificial intelligence, sensor and instrument development, biotechnology, clean energy, sustainable chemistry, and climate research. Experimental, computational, and theoretical chemical research is integrated into core chemistry programs with a strong emphasis on sustainability and the protection of natural resources and environment. CHE encourages researchers to apply chemical understanding and tools to other fields, including biology, engineering, materials research, geosciences, mathematics/statistics, computing, and social sciences. Investments across fields not only expedite chemical understanding, innovation, and translation to market, but also have significant ramifications for the training and deployment of the future STEM workforce. The division uses multiple funding mechanisms to support individuals and team science as well as interdisciplinary user facilities.

Division of Materials Research (DMR). Materials are ubiquitous and are the building blocks of technology and innovation. The development and deployment of advanced materials are major drivers of U.S. economic growth and essentially contribute to assuring national competitiveness and security. Materials research happens at the intersection of materials science & engineering with chemistry, physics, biology, mathematics, and engineering, and it directly and fundamentally impacts life and society, as it shapes our understanding of the world and enables critical advances in electronics, communications, transportation, and health-related fields. DMR invests in the discovery, prediction, design, and harnessing of new materials and materials phenomena, and in the development of the next generation of materials scientists. DMR creates a broad enterprise of investments across scales, including single investigators, teams, and centers; singularly focused research and areas requiring interdisciplinarity; and infrastructure ranging from small instruments to national mid- and large-scale user facilities. DMR investments are contributing to U.S. leadership in high-field magnet science and further aim at democratizing national access to high-magnetic fields. DMR also supports materials-relevant instrumentation and technique development broadly in x-ray and neutron science, nanofabrication, as well in automated and autonomous tools coupled to AI.

Division of Mathematical Sciences (DMS). DMS provides the major federal support for research in the mathematical sciences. DMS investments support research at the forefront of fundamental, applied, and computational mathematics, and statistics that accelerate discovery and innovation. DMS partnerships with other science and engineering disciplines in turn inspire development of new theories and methods applicable to current and future national priority areas such as artificial intelligence, quantum information science, biotechnology, clean energy, and climate science. DMS prioritizes the development and advancement of future researchers in the mathematical sciences, through dedicated workforce programs, enhanced by broadening participation. DMS also supports institutes which advance mathematics and statistics research through thematic programs and workshops on current and emerging trends. DMS builds strong partnerships to expand the impact of its research investments. An example is the DMS partnership with SBE and BIO within NSF and

NIH/NIDA to develop next generation epidemiological models to address the urgent need for reliable modeling tools to inform decision making and to evaluate public health policies during pandemics and other public health crises. DMS partners with private foundations such as the Simons Foundation on programs that support a variety of activities including the National Institute for Theory and Mathematics in Biology and research centers on the Mathematical and Scientific Foundations of Deep Learning.

Division of Physics (PHY). PHY supports fundamental research addressing frontier areas of physics that lead to the understanding of the make-up of the universe, from the formation of stars and galaxies to the principles of life processes on Earth. This research covers a range of physics subfields: atomic, molecular and optical physics, elementary particle physics, gravitational physics, nuclear physics, particle astrophysics and cosmology, physics of living systems, plasma physics, and quantum information science. PHY is the primary supporter of all U.S. research in gravitational physics and the leading supporter of fundamental research in atomic, molecular and optical physics. PHY is a major partner with DOE in support of elementary particle physics, particle astrophysics, nuclear physics, and plasma physics. PHY also has the only U.S. program designed for the support of physics research in living systems. The development of the most advanced cutting-edge computational resources, innovative technology, and new instrumentation is a key part of physics research. Tools developed by the physics community continuously have major impacts in other scientific and engineering fields, allowing PHY to contribute significantly to emerging new technologies such as quantum information science and artificial intelligence.

Office of Strategic Initiatives (OSI). In partnership with MPS divisions and programs, OSI strategically invests in research, education, and infrastructure to support novel and strategic projects that are not readily accommodated by traditional organizational structures and procedures. Funding will focus on strategic priority areas relevant to MPS. As the steward for QIS, OSI will work with all MPS divisions, BIO, EDU, ENG, CISE and OISE to promote convergent approaches to advance quantum science and technology. MPS is the steward for Windows on the Universe (WoU), supporting AST, PHY, and GEO/OPP in activities that bring together fundamental research in electromagnetic waves, high-energy particles, and gravitational waves; and grow the nation's multi-messenger astrophysics, engineering, and data science workforce. OSI will work with AST and PHY to support the design and development of next generation facilities in response to Astro2020 Decadal Survey. OSI will collaborate with all MPS divisions to support their investments in AI for sciences and the science of AI, clean energy, and climate science research. OSI is the steward for the Spectrum Innovation Initiative (SII), which promotes transformative use and management of the electromagnetic spectrum with a focus on dynamic and agile spectrum utilization, benefiting multiple research areas. OSI will continue to foster broadening participation through the Mathematical and Physical Sciences Ascending Postdoctoral Research Fellowship (MPS-Ascend) together with the Faculty Catalyst Awards programs and the Launching Early-Career Academic Pathways in the Mathematical and Physical Sciences program.

