



ASTRONOMY

Earthbound Observations to Interstellar Exploration

American space exploration began with observing the cosmos from Earth. Tools like observatories, telescopes, and planetariums have allowed us to learn about the universe from the safety of the ground. American ingenuity has driven major advances in space exploration, from taking mankind to the Moon and the International Space Station to sending rovers to far away planets and taking photos of black holes.

These scientists and innovators are categorized by how their contributions have impacted how we explore Earth and beyond:



Observing
the Universe
from Earth



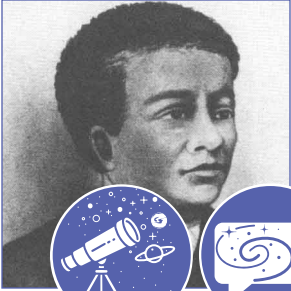
Building Tools for
Space Science



Leaving
Earth



Sharing Science
with the Public



135. Benjamin Banneker (1791)

Benjamin Banneker used astronomy and mathematics to publish almanacs that predicted eclipses and tides, helping early Americans understand the skies through scientific observation.



136. Maria Mitchell (1847)

In 1847, Maria Mitchell discovered a comet by spotting a small blurry object in the sky that did not appear in her charts through her telescope. After this discovery, she became a professor of astronomy and helped found the Association for the Advancement of Women. In her role as a professor, she inspired her female students to believe that they could accomplish the same things as their men counterparts.



137. Gregory Ellery Hale (1908)

In 1908, Gregory Ellery Hale transformed astronomy by building what was then the world's largest telescope in Mount Wilson, California. He broke this record twice, first with a 100-inch telescope in 1917 and then a 200-inch telescope, which was completed in 1948 after his death. Using these telescopes, he discovered that the spots on the sun are the centers of strong magnetic fields, the first magnetic fields detected beyond Earth.



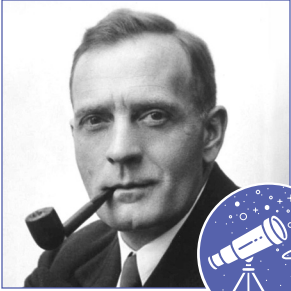
138. Henrietta Swan Leavitt (1912)

Henrietta Swan Leavitt discovered that the luminosity (brightness) and pulsation periods of a Cepheid star—a type of star that brightens and dims on a predictable rhythm—was directly related to its distance from Earth. This realization shaped the future of astronomy by changing how scientists measure the distance of celestial objects.



139. Annie Jump Cannon, Ph.D. (1922)

Dr. Annie Jump Cannon developed the Harvard spectral system for classifying stars by their spectra. In 1922, this classification system was adopted by the International Astronomical Union. In 1931, Cannon became the first woman to be awarded the Henry Draper Medal of honor from the National Academy of Sciences. She classified an astonishing 350,000 stars over the course of her career.



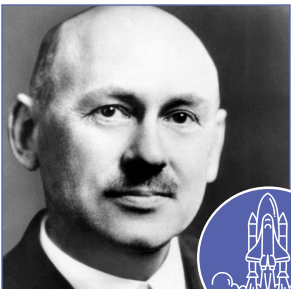
140. Edwin Hubble, Ph.D. (1924)

Dr. Edwin Hubble discovered that galaxies exist beyond the Milky Way and that the universe is constantly expanding, completely changing our understanding of space. He also coined Hubble's Law, which states that the further a galaxy is from Earth, the redder its light appears.



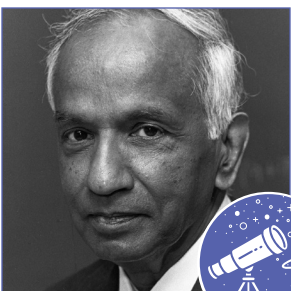
141. Cecilia Payne-Gaposchkin, Ph.D. (1925)

Dr. Cecilia Payne-Gaposchkin was a British American astronomer who was the first scientist to describe the chemical composition of stars, which are composed mainly of hydrogen and helium. Her work was of fundamental importance in developing the study of stellar atmospheres, and her observations and analyses of variable stars laid the foundation for their use as indicators of galactic structure.



142. Robert H. Goddard, Ph.D. (1926)

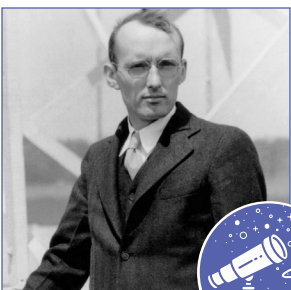
Dr. Robert H. Goddard is considered one of the founding fathers of modern-day rocketry. In 1926, Goddard successfully launched the world's first liquid-propelled rocket. In 1959, 15 years after Goddard's death, NASA established the Goddard Space Flight Center in his memory.



143. Subrahmanyan Chandrasekhar, Ph.D. (1931)

In 1931, Dr. Subrahmanyan Chandrasekhar published research that showed that the maximum mass a white dwarf star can reach before collapsing into a neutron star or black hole is about 1.4 times the mass of our Sun. This is now known as the Chandrasekhar Limit. This discovery earned Chandrasekhar the Nobel Prize in Physics in 1983.

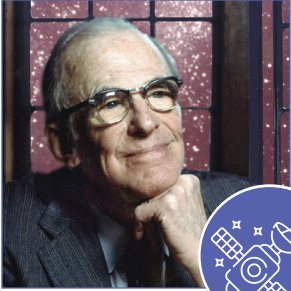
Credit: American Institute of Physics



144. Karl Guthe Jansky (1933)

Karl Guthe Jansky was a radio engineer working at Bell Laboratories when he was tasked with finding the source of some static interference. He discovered that the source of the static was radio waves coming from the center of the Milky Way galaxy. Today, Jansky is considered one of the founders of radio astronomy and has a unit of radio wave emission strength named after him.

Credit: National Radio Astronomy Observatory



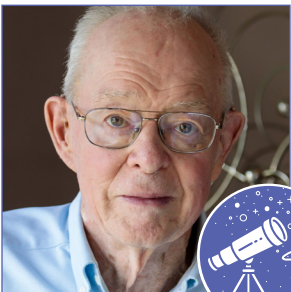
145. Lyman Spitzer, Ph.D. (1946)

Dr. Lyman Spitzer came up with the idea of sending a telescope into orbit around Earth to better observe space. He hypothesized that light would be able to reach a telescope in space more easily than it can reach the ground, due to the distorting effect of Earth’s atmosphere. Spitzer’s legacy is to help us see more clearly and farther than before.



146. James A. Van Allen, Ph.D. (1958)

In 1958, Dr. James A. Van Allen was asked to install a Geiger-Müller tube, a type of Geiger counter, onto the American satellites Explorer 1 and Explorer 3. Data collected from these satellites showed that two circular belts of charged particle radiation wrapped around the Earth. These radioactive areas were named the Van Allen radiation belts. Over the course of his career, Van Allen provided similar detectors to 20 other spacecraft projects, which helped him discover that Jupiter and Saturn also had strong radiation belts.



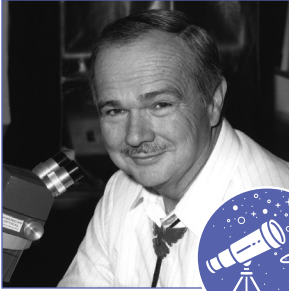
147. Eugene Newman Parker, Ph.D. (1958)

Dr. Eugene Newman Parker mathematically predicted the existence of solar wind in 1958. In 1962, his prediction was confirmed with data taken from the Mariner 2 spacecraft. Parker went on to discover other phenomena that occur on the Sun and was known as the “Father of Heliophysics.” In 2018, he became the first living person to have a spacecraft named after him, the Parker Solar Probe.



148. Nancy Grace Roman, Ph.D. (1959)

Dr. Nancy Roman, also known as the “Mother of Hubble,” spearheaded the concept for the Hubble telescope, secured its funding, and oversaw its planning. As NASA’s first Chief of Astronomy, Roman established the entire framework for space-based observatories. In 1959, she proposed that space telescopes could be used to find planets outside our solar system. This paved the way for missions like the upcoming Roman, which will launch the Nancy Grace Roman Space Telescope into space to investigate dark matter and dark energy.



149. Eugene Merle Shoemaker, Ph.D. (1960)

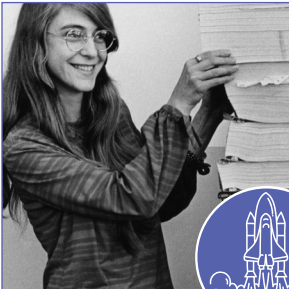
Dr. Eugene Merle Shoemaker helped pioneer the field of astrogeology by founding the Astrogeology Research Program with the U.S Geological Survey. In his work, he studied impact craters and was involved in lunar missions, helping the scientific community better understand the vast number of impact craters on the Moon's surface.



Credit: American Institute of Physics

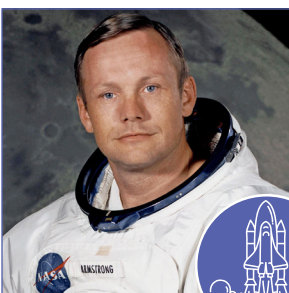
150. Vera Florence Cooper Rubin, Ph.D. (1968)

Dr. Vera Florence Cooper Rubin was an astronomer best known for her discovery that galaxies contain a massive amount of unseen matter, now called dark matter. She provided key evidence that showed that stars in the outer parts of galaxies orbit the center of their galaxy just as fast as stars near the center, which would not be possible with the amount of visible matter in these galaxies. Her research established that visible matter makes up only a small portion of the universe's total mass, fundamentally changing our understanding of the cosmos.



151. Margaret Hamilton (1969)

Margaret Hamilton took a job as a programmer at MIT after graduating with an undergraduate degree in mathematics. NASA contracted with MIT to develop software for its Apollo program in 1961, and by 1965, Hamilton was spearheading onboard flight software for the Apollo computers. She and her team developed the Apollo program's guidance system which helped land humans on the moon for the first time in 1969. Hamilton also created the term "software engineering," positioning her field as a science.



152. Neil A. Armstrong (1969)

Neil Armstrong was a naval aviator before becoming an aeronautical research pilot for NASA's High-Speed Flight Station, now known as the Armstrong Flight Research Center. In 1966, Armstrong commanded his first mission, Gemini 8, and in 1969, he commanded the Apollo 11 lunar landing mission. On July 20, 1969, Armstrong became the first man on the Moon.



153. Judith Love Cohen (1970)

Judith Love Cohen is famous for her work on NASA's Abort Guidance System for the Apollo program, which helped safely return the Apollo 13 astronauts to Earth after an explosion on board. After Apollo, she helped develop guidance systems for the Minuteman missile and ground systems for the Hubble Space Telescope. Later, she wrote children's books to inspire girls to enter STEM fields through her publishing company, Cascade Pass.



154. Jack Horkheimer (1976)

Jack Horkheimer was a pioneering astronomy educator and the longtime director of the Miami Space Transit Planetarium, which later became Frost Science. Through his planetarium programs and TV series Star Hustlers, later renamed Star Gazers, he made observing the universe accessible and engaging for millions of people. His legacy lives on through all the programs shown at the Frost Planetarium.



155. Carl Sagan, Ph.D. (1980)

Astronomer Dr. Carl Sagan was the director of the Laboratory for Planetary Studies at Cornell and produced a television series, Cosmos, that translated complex space science into stories that helped millions connect emotionally to the universe. Sagan also proposed that NASA take a photograph of the Earth from over 3.5 billion miles away, resulting in the famous photograph titled Pale Blue Dot from the Voyager 1 Space Probe.



156. Sally Ride, Ph.D. (1983)

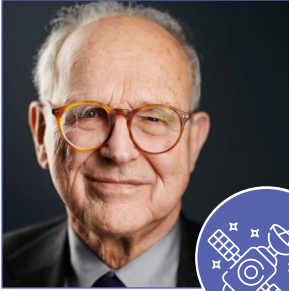
Dr. Sally Ride was chosen to be part of NASA Astronaut Group 8, the first group of astronauts to include women, in 1978. In 1983, she became the first American woman in space, flying in the Space Shuttle Challenger. Ride later founded the nonprofit Sally Ride Science to promote STEM literacy and inspire children to pursue careers in STEM.



157. Kip Stephen Thorne, Ph.D. (1984)

Dr. Kip Stephen Thorne is known for co-founding the Laser Interferometer Gravitational-Wave Observatory (LIGO) project in 1984. LIGO made history in 2015, when it detected gravitational waves that showed two massive black holes spiraling into each other, to become one large black hole 62 times the mass of the Sun. Today, LIGO continues to help us "see" space in a way we have not before, helping scientists unveil the mysteries of the universe.



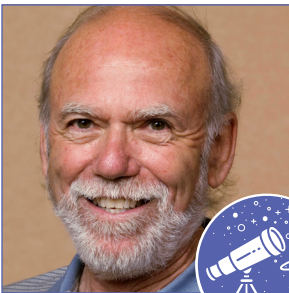


© Nobel Prize Outreach.
Photo: A. Mahmoud



158. Rainer Weiss, Ph.D. (1984)

Dr. Rainer Weiss developed the concept for a laser-based interferometer that he believed could detect gravitational waves and shared his invention with Dr. Kip Thorne. Together, Weiss and Thorne co-founded the Laser Interferometer Gravitational-Wave Observatory (LIGO) project. Weiss and his co-workers prototyped and produced a full-scale interferometer that was successfully able to detect gravitational waves. Weiss, Thorne, and their colleague Dr. Barry Barish won the 2017 Nobel Prize in Physics for this work.



159. Barry Clark Barish, Ph.D. (1984)

Dr. Barry Clark Barish is a physicist and the former director of the LIGO Scientific Collaboration, where he detected and observed cosmic gravitational waves for the first time. These observations validated part of Einstein's Theory of General Relativity. He and his colleagues, Dr. Kip Thorne and Dr. Rainer Weiss, won the 2017 Nobel Prize in Physics for their gravitational wave discoveries.



160. Olga D. González-Sanabria (1988)

Olga D. González-Sanabria is a Puerto Rican American scientist and inventor. As the former Director of Engineering and Technical Services at the NASA Glenn Research Center, she was responsible for planning and directing engineering, fabrication, testing, facility management, and aircraft services. She also played a significant role in the development of long-cycle nickel-hydrogen batteries, which have been used for energy storage on the International Space Station.



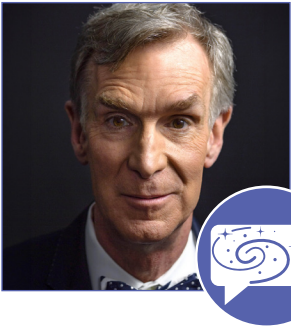
161. Mae Carol Jemison, M.D. (1992)

Dr. Mae Carol Jemison was a medical doctor and Peace Corps officer who, in the wake of the Challenger tragedy, applied to become an astronaut candidate. She was one of 15 out of 2,000 applicants chosen for NASA Astronaut Group 12. In 1992, she was assigned to the STS-47 crew as a mission specialist. She became the first African-American woman in space when she flew on the Space Shuttle Endeavour.



162. Ellen Ochoa, Ph.D. (1993)

Dr. Ellen Ochoa is a Mexican American engineer, former astronaut, and the former director of the Johnson Space Center. Her research focused on how to use light to process information, making computers more effective at analyzing images. While working for NASA, Ochoa co-invented three optical devices for information processing. In 1993, Ochoa became the first Latina in space when she served on a nine-day mission aboard the Space Shuttle Discovery.



163. William Sanford Nye (1993)

William Sanford Nye is most well-known for producing, writing, and hosting his award-winning TV show, *Bill Nye the Science Guy*, which ran from 1993 to 1999. Today, Nye continues to share his passion for science communication and space exploration by leading the Planetary Society as CEO. He continues to inspire and entertain audiences and is a fierce advocate for science.



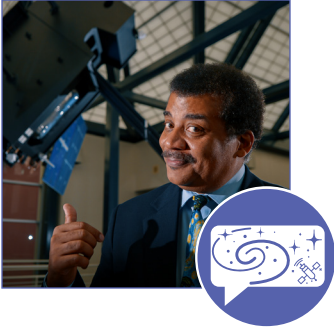
164. Beth Anne Brown, Ph.D. (1994)

Dr. Beth Anne Brown compiled the first large sample of X-ray observations of elliptical galaxies and helped improve scientific understanding of black holes and galactical formations. She also expanded public access to astronomy by developing NASA education and outreach programs that brought space discoveries to a wider audience.



165. Captain Winston Elliott Scott (1996)

Captain Winston Elliott Scott flew two Space Shuttle missions (STS-72 & STS-87), performed three spacewalks totaling over 19 hours, and logged 24 days in space. In his time with NASA, Scott helped develop assembly techniques used in the construction of the International Space Station. Scott is also an accomplished pilot and wrapped up his influential career as a leader in aerospace education at the Florida Institute of Technology in Melbourne, Florida.



166. Neil deGrasse Tyson, Ph.D. (1997)

Dr. Neil deGrasse Tyson’s early research focused on stellar evolution and galactic structure, and, in 1997, he founded the Department of Astrophysics at the American Museum of Natural History. While Tyson has published dozens of scientific papers, he is most well-known as a prolific science communicator, bringing complicated scientific content to the general public.



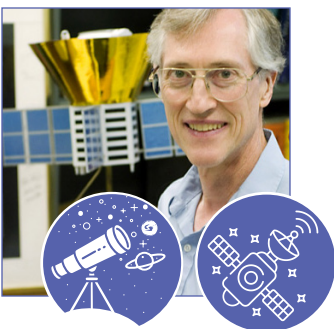
167. George Fitzgerald Smoot III, Ph.D. (1997)

Dr. George Fitzgerald Smoot III and his colleague, Dr. John Mather, worked on the Cosmic Background Explorer (COBE) satellite, which was used to detect small changes in the temperature of the cosmic microwave background for the first time. Cosmic microwave background is radiation present throughout the observable universe. The data collected from COBE helps support the Big Bang Theory.



168. Wanda Diaz-Merced, Ph.D. (2005)

Dr. Wanda Diaz-Merced developed techniques to read and share space data with sound. At the same time she was doing this research, she was losing her eyesight, and hearing space gave her a new way to engage with data. Her work expanded how people can experience and understand astronomical information and helped create more accessible astronomy programs.



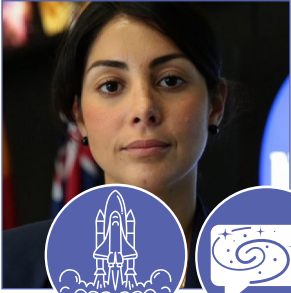
169. John Cromwell Mather, Ph.D. (2006)

Dr. John Cromwell Mather is the senior astrophysicist for the Observational Cosmology Laboratory at NASA’s Goddard Space Flight Center. In 2006, he and his colleague Dr. George Smoot won the Nobel Prize in Physics for their work on cosmic background radiation using the Cosmic Background Explorer (COBE) satellite. Their data showed that there was cosmic background radiation in the universe leftover from a large creation event, supporting the Big Bang Theory.



170. Nergis Mavalvala, Ph.D. (2015)

Dr. Nergis Mavalvala is a Pakistani American astrophysicist whose major scientific contributions focused on enhancing gravitational wave detection. Most of Mavalvala’s pioneering work was on quantum states of light, which significantly improved the sensitivity of Laser Interferometer Gravitational-Wave Observatory (LIGO) detectors. Her research led to more precise measurements and a higher rate of discoveries, including the first direct detection of gravitational waves from the merging of two black holes.



171. Diana Trujillo (2020)

Diana Trujillo is an aerospace engineer, the 108th Flight Director in NASA’s history, and the first Flight Director born in a Spanish-speaking country. She had key leadership roles in the Mars Perseverance, Curiosity, and Ingenuity missions. Trujillo also created NASA’s first ever Spanish broadcast of a major mission, viewed by millions of people around the world, and advocates for diversity in STEM.



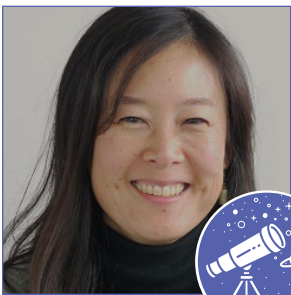
172. Darlene Lim, Ph.D. (2020)

Dr. Darlene Lim is an exobiologist and geobiologist who ensures astronauts are prepared for future exploration of the Moon, Mars, and deep space. In 2020, Lim joined NASA’s VIPER lunar rover mission team, which was supposed to help search the Moon for ice and other potential resources. The mission was canceled in 2024 because of funding issues but revived in 2025. Lim currently serves as the deputy lead project scientist for the project.



173. Jane Rigby, Ph.D. (2023)

Dr. Jane Rigby was named senior project scientist for the James Webb Space Telescope (JWST) in 2023. Rigby’s work with the JWST has helped the telescope produce clearer and brighter images and create images of gravitationally lensed light for the first time. Rigby has also advocated for LGBTQ+ scientists in the astronomy field since 2000, supporting efforts to make the field more welcoming for underrepresented groups. (Icon: Observing the Universe from Earth)



174. Nancy Y. Kiang, Ph.D. (2024)

Dr. Nancy Y. Kiang’s research focuses on the interactions between the biosphere and atmosphere on Earth. Kiang also uses what she learns about these interactions on Earth to look for “biosignatures,” potential signs of life that could be detected using telescopes, on other planets.

ASTRONOMY

Earthbound Observations to Interstellar Exploration

1791	Benjamin Banneker
1847	Maria Mitchell
1908	Gregory Ellery Hale
1912	Henrietta Swan Leavitt
1922	Annie Jump Cannon Ph.D.
1924	Edwin Hubble, Ph.D.
1925	Cecilia Payne-Gaposchkin, Ph.D.
1926	Robert H. Goddard, Ph.D.
1931	Subrahmanyan Chandrasekhar, Ph.D.
1933	Karl Guthe Jansky
1946	Lyman Spitzer, Ph.D.
1958	Eugene Newman Parker, Ph.D.
1958	James A. Van Allen, Ph.D.
1959	Nancy Grace Roman, Ph.D.
1960	Eugene Merle Shoemaker, Ph.D.
1968	Vera Florence Cooper Rubin, Ph.D.
1969	Margaret Hamilton
1969	Neil A. Armstrong
1970	Judith Love Cohen
1976	Jack Horkheimer
1980	Carl Sagan, Ph.D.
1983	Sally Ride, Ph.D.
1984	Kip Stephen Thorne, Ph.D.
1984	Rainer Weiss, Ph.D.
1984	Barry Clark Barish, Ph.D.
1988	Olga D. Gonzalez-Sanabria
1992	Mae Carol Jemison, M.D.
1993	William Sanford Nye
1993	Ellen Ochoa, Ph.D.
1994	Beth Anne Brown, Ph.D.
1996	Captain Winston Elliott Scott
1997	George Fitzgerald Smoot III, Ph.D.
1997	Neil deGrasse Tyson, Ph.D.
2005	Wanda Diaz-Merced, Ph.D.
2006	John Cromwell Mather, Ph.D.
2015	Nergis Mavalvala, Ph.D.
2020	Darlene Lim, Ph.D.
2020	Diana Trujillo
2023	Jane Rigby, Ph.D.
2024	Nancy Y. Kiang, Ph.D.

Earthbound Observations to Interstellar Exploration

Building Tools for Space Science



1946	Lyman Spitzer, Ph.D.
1958	James A. Van Allen, Ph.D.
1959	Nancy Grace Roman, Ph.D.
1984	Kip Stephen Thorne, Ph.D.
1984	Rainer Weiss, Ph.D.
1988	Olga D. Gonzalez-Sanabria
2005	Wanda Diaz-Merced, Ph.D.

Leaving Earth



1926	Robert H. Goddard, Ph.D.
1969	Margaret Hamilton
1969	Neil A. Armstrong
1970	Judith Love Cohen
1983	Sally Ride, Ph.D.
1992	Mae Carol Jemison, M.D.
1993	Ellen Ochoa, Ph.D.
1996	Captain Winston Elliott Scott
2020	Darlene Lim, Ph.D.
	Diana Trujillo

Observing the Universe from Earth



1791	Benjamin Banneker
1847	Maria Mitchell
1908	Gregory Ellery Hale
1912	Henrietta Swan Leavitt
1922	Annie Jump Cannon Ph.D.
1924	Edwin Hubble, Ph.D.
1925	Cecilia Payne-Gaposchkin, Ph.D.
1931	Subrahmanyan Chandrasekhar, Ph.D.
1933	Karl Guthe Jansky
1958	Eugene Newman Parker, Ph.D.
1960	Eugene Merle Shoemaker, Ph.D.
1968	Vera Florence Cooper Rubin, Ph.D.
1984	Barry Clark Barish, Ph.D.
1997	George Fitzgerald Smoot III, Ph.D.
2006	John Cromwell Mather, Ph.D.
2015	Nergis Mavalvala, Ph.D.
2023	Jane Rigby, Ph.D.
2024	Nancy Y. Kiang, Ph.D.

Sharing Science with the Public



1976	Jack Horkheimer
1980	Carl Sagan, Ph.D.
1993	William Sanford Nye
1994	Beth Anne Brown, Ph.D.
1997	Neil deGrasse Tyson, Ph.D.