Barry C. Barish

Barry C. Barish, the Ronald and Maxine Linde Professor of Physics, Emeritus, at Caltech, and recipient of the 2017 Nobel Prize in Physics, is a former director of the Laser Interferometer Gravitational-wave Observatory (LIGO). In the late 1990s and early 2000s, Barish helped transform LIGO into the large-scale international collaboration it is today.

On September 14, 2015, LIGO made the first-ever observation of ripples in the fabric of space and time—or gravitational waves—arriving at Earth from the collision of two black holes in the distant universe. The discovery confirmed a major prediction of Albert Einstein's general theory of relativity, proposed more than 100 years ago, and provides a new way to observe the cosmos.

Barish was born on January 27, 1936, in Omaha, Nebraska, and spent his childhood in Los Angeles. He received his BA in physics in 1957 and his PhD in experimental particle physics in 1962, both from UC Berkeley. In 1963, he joined Caltech as a research fellow. He became an assistant professor in 1966, an associate professor in 1969, and a professor of physics in 1972. He was named the Ronald and Maxine Linde Professor of Physics in 1991 and Linde Professor, Emeritus, in 2005.

Earlier in his career, Barish developed the first high-energy neutrino beam experiment at Fermilab. This experiment revealed evidence for the quark substructure of the nucleon (a proton or neutron) and provided crucial evidence supporting the electroweak unification theory of Nobel Laureates Sheldon Glashow, Abdus Salam, and Steven Weinberg.

Following the neutrino experiment, Barish, along with his Caltech colleague Charles W. Peck (PhD '64), was one of the leaders of a large international collaboration that performed a search for magnetic monopoles. Magnetic monopoles are the magnetic analog of single electric charges and have been sought for more than 100 years. They could help confirm a Grand Unified Theory that seeks to unify three of nature's four forces—the electromagnetic, weak, and strong forces—into a single force. The experiment, called MACRO (Monopole, Astrophysics and Cosmic Ray Observatory), was located 3,200 feet under Gran Sasso mountain in Italy. Although the experiment did not find magnetic monopoles, it set what are still the most stringent limits on their existence. MACRO also provided some of the key evidence that neutrinos have mass.

Barish also was co-leader of the design effort for the Gamma Electron Muon (GEM) detector, one of the two large detectors for the planned Superconducting Super Collider in Waxahachie, Texas. The accelerator was canceled by Congress during construction in 1993, but major elements of the GEM design and many members of the team are now integrated into the Large Hadron Collider (LHC) detector projects at the European Organization for Nuclear Research (CERN) in Geneva, Switzerland.

Barish was the principal investigator for LIGO from 1994 to 2005 and director of the LIGO Laboratory from 1997 until 2005. He led LIGO through its final design stages and, under his leadership, the project was funded by the National Science Board of the National Science Foundation (NSF) and the construction of the twin LIGO interferometers in Hanford, Washington, and Livingston, Louisiana, was completed. In 1997, he established the LIGO Scientific Collaboration (LSC), an organization that includes more than 1,000 collaborators worldwide and has a mission to detect gravitational waves, explore the fundamental physics of gravity, and develop gravitational-wave observations as a tool of astronomical discovery.

He also oversaw the development and approval of the proposal for Advanced LIGO, a program that majorly upgraded the facility and increased the sensitivity of the instruments compared to the first-generation LIGO detectors. Advanced LIGO enabled a large increase in the volume of the universe probed—and the discovery of gravitational waves during its first observation run.

After LIGO, Barish was director of the Global Design Effort for the International Linear Collider (ILC)—an international team that oversaw the planning, design, and research and development program for the ILC—from 2006 to 2013. The ILC is expected to explore the same energy range in particle physics being investigated by the LHC, but with more precision.

From 2003 to 2009, Barish was a member of the National Science Board, a 24-member advisory board that helps to oversee the NSF and advises the president and Congress on policy issues related to science, engineering, and education. In 2001, he served as co-chair of the High Energy Physics Advisory Panel subpanel that developed a long-range plan for U.S. high-energy physics. He also chaired the Commission on Particles and Fields and the U.S. Liaison Committee to the International Union of Pure and Applied Physics.

He is a member of the National Academy of Sciences, and a fellow of the American Academy of Arts and Sciences, the American Association for the Advancement of Science, and the American Physical Society, the latter of which he served as president. In 2002, he received the Klopsteg Memorial Lecture Award from the American Association of Physics Teachers and, in 2016, he received the Enrico Fermi Prize from the Italian Physical Society. He won the Henry Draper Medal in 2017 with Stan Whitcomb (BS '73), chief scientist for the LIGO Laboratory. In 2017, he won the Princess of Asturias Award for Technical and Scientific Research together with Kip S. Thorne (BS '62), Caltech's Richard P. Feynman Professor of Theoretical Physics, Emeritus; Rainer Weiss of MIT; and the entire LSC. He also won the 2017 European Physical Society's Giuseppe and Vanna Cocconi Prize and the Fudan University's Fudan-Zhongzhi Science Award, both with Thorne and Weiss. He holds honorary doctoral degrees from the University of Bologna, the University of Florida, and the University of Glasgow.