



GRUBER
FOUNDATION

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FOR IMMEDIATE RELEASE

**FREEDMAN, KENNICUTT, AND MOULD SHARE \$500,000
GRUBER COSMOLOGY PRIZE FOR THEIR WORK ON RESOLVING
THE VALUE OF THE HUBBLE CONSTANT, THE KEY DETERMINANT FOR
HOW FAST THE UNIVERSE IS EXPANDING**

July Celebration to Mark 10th Anniversary of Gruber International Prize Program,
Which Began with Cosmology Prize



Wendy Freedman



Robert Kennicutt



Jeremy Mould

June 3, 2009, New York, New York – The recipients of the 2009 Cosmology Prize of the Peter and Patricia Gruber Foundation are **Wendy Freedman**, director of the Observatories of the Carnegie Institution of Washington in Pasadena, California; **Robert Kennicutt**, director of the Institute of Astronomy at the University of Cambridge in England; and **Jeremy Mould**, professorial fellow at the University of Melbourne School of Physics. These three renowned astronomers are being honored for their leadership in the definitive measurement of the value of the Hubble constant, one of the most important numbers in astronomy. The Hubble constant indicates the rate at which the universe has been expanding since the “Big Bang,” thus connecting the universe’s age with its size. The Cosmology Prize was the first to be awarded when the Gruber international Prize Program was inaugurated in 2000; and its tenth anniversary, which the Foundation will celebrate this summer, coincides with the International Year of Astronomy.

Freedman, Kennicutt, and Mould will receive the Prize on August 4, 2009, at the opening ceremony of the International Astronomical Union’s General Assembly in Rio de Janeiro, Brazil. The prize consists of a gold medal and \$500,000. At the same time, Dr. M.B.N. Kouwenhoven, a young researcher at the University of Sheffield, UK, will be recognized as the 2009 recipient of a \$50,000 grant through the PPGF Fellowship Programme, an annual fellowship sponsored by the IAU and the Gruber Foundation.

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"The Hubble constant ties time and space together," says Professor Ron Ekers, past President of the IAU. "As soon as Hubble saw that the universe was expanding, astronomers recognized that this number was the key to understanding the universe's history. It is most appropriate that in the International Year of Astronomy the Gruber Foundation has awarded the Cosmology prize to the team that has made the definitive measurement of the Hubble constant. Galileo's observations answered the question of where we are in the universe – these Hubble Space Telescope observations answer mankind's quest to know how big and how old it is."

The precise value of the Hubble constant was hotly debated for decades—ever since 1929, when the American astronomer Edwin P. Hubble first realized that the galaxies are moving away from each other at a speed proportional to their distance. The galaxies farthest away are receding the fastest, he determined. But how fast? Initially, Hubble calculated a speed of 500 kilometers per second per megaparsec (km/s/Mpc). (A megaparsec is 3.26 million light years, and a light year is about 5.9 trillion miles.) By the 1980s, scientists had narrowed the Hubble constant to within 50 and 100 km/s/Mpc, but they did not agree on whether the value was at the high or low end of this range. A low number would indicate a slow expansion—and, thus, a universe about 20 billion years old. A high number would suggest a fast expansion—and a relatively young universe of about 10 billion years.

Freedman, Kennicutt, and Mould essentially resolved this long-standing dispute. They led the Hubble Space Telescope Key Project on the Extragalactic Distance Scale, one of the three major projects of the Hubble Space Telescope when it was launched in 1990. Working with a team of more than two dozen astronomers at 13 different institutions around the world, Freedman, Kennicutt, and Mould determined that the best value of the Hubble constant is 72 km/s/Mpc, with an uncertainty of only 10 percent. This finding, which was published in final form in 2001, means the universe is 14 billion years old—which agrees with the age estimates for the oldest stars.

To reach its conclusion about the value of the Hubble constant, the Hubble Space Telescope Key Project team observed Cepheids, extremely bright, pulsating stars whose periodic brightening and dimming provide a reliable "standard candle" that astronomers can use to estimate extragalactic distances. During the ten-year life of the project, the team discovered almost 800 Cepheids in 18 galaxies, and used a wide variety of methods for meticulously measuring and analyzing their distances.

The resolution of the decades-long debate about the value of the Hubble constant is enabling scientists to answer fundamental questions about the universe. For example, in addition to reconciling the age of the universe (the time since the Big Bang) with the ages of the oldest stars, astronomers are now able to more accurately estimate the density of the universe—a factor that will determine the fate of the universe, whether it expands forever, as most cosmologists currently believe, or eventually collapses back on itself.





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"Generations of astronomers have worked to frame the question – how fast is the universe expanding? – and then to discover how to measure the answer," says Philip James E. Peebles, Albert Einstein Professor of Science and professor emeritus of physics at Princeton University. "Freedman, Kennicutt, Mould and their colleagues have at last completed this great task. The result is an essential part of the web of tests that show how our universe has expanded from a hot dense state."

Additional Information

The official citation reads:

The Peter and Patricia Gruber Foundation proudly presents the 2009 Cosmology Prize to Wendy Freedman, Robert Kennicutt and Jeremy Mould for the definitive measurement of the rate of expansion of the universe, Hubble's Constant. This parameter effectively determines the age of the universe at the current time and underpins every other basic cosmological measurement.

An accurate measurement of the expansion rate was one of three major goals of the Hubble Space Telescope when it was launched in 1990. From meticulous measurements of a particular kind of variable star, the Cepheids, Freedman, Kennicutt and Mould met this goal, resolving one of the longest-standing debates in the history of modern cosmology.

Laureates of the Gruber Cosmology Prize

2008: J. Richard Bond for his pioneering contributions to our understanding of the development of structures in the Universe

2007: Saul Perlmutter and Brian Schmidt and their teams: the Supernova Cosmology Project and the High-z Supernova Search Team, for independently discovering that the expansion of the Universe is accelerating

2006: John Mather and the Cosmic Background Explorer (COBE) Team for studies confirming that our universe was born in a hot Big Bang

2005: James E. Gunn for leading the design of a silicon-based camera for the Hubble Space Telescope and developing the original concept for the Sloan Digital Sky Survey

2004: Alan Guth and Andrei Linde for their roles in developing and refining the theory of cosmic inflation

2003: Rashid Alievich Sunyaev for his pioneering work on the nature of the cosmic microwave background and its interaction with intervening matter

2002: Vera Rubin for discovering that much of the Universe is unseen black matter, through her studies of the rotation of spiral galaxies

2001: Martin Rees for his extraordinary intuition in unraveling the complexities of the universe

2000: Allan R. Sandage and Phillip J. E. (Jim) Peebles: Sandage for pursuing the true values of the Hubble constant, the deceleration parameter and the age of the universe; Peebles for advancing our understanding of how energy and matter formed the rich patterns of galaxies observed today

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The Prize recipients are chosen by the Cosmology Selection Advisory Board. Its members are:

Jacqueline Bergeron, Institut d'Astrophysique-CNRS

Peter Galison, Harvard University

Ronald Ekers, Australia Telescope National Facility - CSIRO

Andrei Linde, Stanford University

Julio F. Navarro, University of Victoria

James Peebles, Princeton University

Roger Penrose, University of Oxford

Owen Gingerich of the Harvard-Smithsonian Center for Astrophysics, and **Virginia Trimble** of the University of California, Irvine, also serve as special cosmology advisors to the Foundation.

On July 1, 2009, the recipients of the 2009 Genetics and Neuroscience Prizes will be announced at Rockefeller University in New York City in conjunction with the celebration of the tenth anniversary of the Gruber Prizes. The event will include a symposium entitled "DNA, the Brain, and Society," featuring distinguished scientists David Botstein, Linda Buck, Fred Gage, and Solomon Snyder. For details, visit:

<http://www.gruberprizes.org/GruberPrizes/TenthAnniversary.php>

The Gruber Prize Program honors contemporary individuals in the fields of Cosmology, Genetics, Neuroscience, Justice and Women's Rights, whose ground-breaking work provides new models that inspire and enable fundamental shifts in knowledge and culture. The Selection Advisory Boards choose individuals whose contributions in their respective fields advance our knowledge, potentially have a profound impact on our lives, and, in the case of the Justice and Women's Rights Prizes, demonstrate courage and commitment in the face of significant obstacles.

The Peter and Patricia Gruber Foundation honors and encourages educational excellence, social justice and scientific achievements that better the human condition. For more information about Foundation guidelines and priorities, please visit www.gruberprizes.org.

Affiliation with International Astronomical Union

In 2000, the Peter and Patricia Gruber Foundation and the International Astronomical Union (IAU) announced an agreement by which the IAU provides its expertise and contacts with professional astronomers worldwide for the nomination and selection of Cosmology Prize winners. Under the agreement, the Peter and Patricia Gruber Foundation also funds a fellowship program for young astronomers, with the aim of promoting the continued recruitment of new talent into the field.

The International Astronomical Union, founded in 1919, is an organization of professional astronomers. It serves today a membership of more than 9,000 individual astronomers from 85 countries, worldwide. Information about the activities of the IAU is available from www.iau.org.

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