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Richard Ellis

## Richard Ellis Receives \$500,000 Gruber Cosmology Prize

**April 12, 2023, New Haven, CT** — The 2023 Gruber Cosmology Prize recognizes Richard Ellis of University College London for his pioneering work both studying galactic evolution dating to the “cosmic dawn” and designing innovative instruments with which to do so.

Ellis will receive the \$500,000 award as well as a gold laureate pin at a ceremony that will take place in July at the ‘Shedding New Light on the First Billion Years of the Universe’ conference organized by the Galaxies, Etoiles et Cosmologie (GECO) team of the Laboratoire d’Astrophysique of Marseille, in Marseille, France. The citation cites his “broad contributions in the fields of galaxy evolution” as well as his role as “the driver of many frontier instrumental developments in optical Astronomy.”

His dual proficiency in observation and instrumentation would alone make Ellis an anomaly among astrophysicists. That his contributions in both areas have proved revolutionary might well make him unique.

As an observer, Ellis has redefined cosmology, the science that studies the growth of the universe. Because the speed of light is finite, astronomers can trace the evolution of galactic structures in reverse, starting with the nearest and most mature and extending to the earliest and most primitive. Over the decades Ellis has repeatedly led surveys of galaxies farther and farther, earlier and earlier across the cosmic landscape.

In a series of landmark studies in the 1990s and 2000s he reconstructed the evolutionary processes that galaxies have undergone in the last 7 billion or so years, or well more than halfway back to the Big Bang. In subsequent surveys he and his collaborators have probed two significant stages far earlier in the development of the universe.

First was the era of reionization, a period within the first billion years after the Big Bang when neutral hydrogen atoms were split into positively charged protons and free electrons. That process, in turn, would have occurred during the emergence of the first galaxies from the gravitational collapse of

primordial, opaque clouds of neutral hydrogen—a period of first light which cosmologists have come to call the cosmic dawn, and which Ellis and collaborators determined to have occurred about 250 million years after the Big Bang.

As “the leading authority on galaxy evolution,” as one Gruber nominator called him, Ellis has for decades been a fixture on astronomical projects requiring deep probes. In the mid-1990s he was the sole Europe-based member on the committee to outline the scientific goals for what was then the Next Generation Space Telescope and is now the James Webb Space Telescope. He was a natural fit for the Supernova Cosmology Project, one of the two teams that discovered evidence that the expansion of the universe is accelerating (2007 Gruber Prize; 2011 Nobel Prize). Ellis was also the principal investigator on the 2012 Hubble Ultra Deep Field campaign, which provided the first census of star-forming galaxies less than a billion years after the Big Bang.

As Ellis’s observations have taken him farther and farther across the universe into realms that were previously inaccessible, he has found himself needing to adopt or invent new tools.

One challenge was to observe the light from distant galaxies. In order to do so, Ellis was one of the first astronomers to use massive galaxy clusters as “gravitational lenses” that (as Einstein’s general relativity predicted) magnify the otherwise inaccessible light “behind” them.

Realizing the challenges of efficiently studying faint galaxies, Ellis devoted much of his career to promoting innovative instruments. He devised, funded, and oversaw the development of several forms of spectrographs that allow astronomers to study gas compositions in the earliest star-forming galaxies. In turn, those instruments have helped other cosmologists make discoveries about the fundamental nature of the early universe.

Ellis has also occupied many prestigious academic, research, or administrative positions, including: senior scientist at the European Southern Observatory; director of the Palomar Observatory (now Caltech Optical Observatories); director of the Institute of Astronomy at Cambridge University. In 2017 he returned, as a professor of astronomy, to University College London, from which he received his Bachelor of Science in astronomy in 1971.

### Additional Information

In addition to the cash award, the recipient will receive a gold laureate pin and a citation that reads:

*The Gruber Foundation is pleased to present the 2023 Cosmology Prize to Richard Ellis for his numerous contributions in the fields of galaxy evolution, the onset of cosmic dawn and reionization in the high redshift universe, and the detection of the earliest galaxies via the Hubble Ultra Deep Field study.*

*Richard Ellis has also driven several frontier instrumental developments in optical astronomy, especially the use of multi-object spectroscopy to study many galaxies in the same field of view. These included the "autofib" instrument, the "2dF" facility on the Anglo-Australian Telescope, which led to the discovery of baryon acoustic oscillations, the "LDSS" on the Herschel Telescope, which studied the redshifts of faint galaxies, and the "PFS" currently under commissioning on the Subaru Telescope to study dark matter and dark energy.*

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The Cosmology Prize honors a leading cosmologist, astronomer, astrophysicist or scientific philosopher for theoretical, analytical, conceptual or observational discoveries leading to fundamental advances in our understanding of the universe.

Laureates of the Gruber Cosmology Prize:

- **2022 Frank Eisenhauer**, designed instruments that collected evidence for a black hole at the center of our galaxy
- **2021 Marc Kamionkowski, Uroš Seljak, and Matias Zaldarriaga**, for contributions to methods essential for studying the early universe
- **2020: Lars Hernquist and Volker Springel**, for computer simulations that revolutionized the study of processes behind the structure of the cosmos
- **2019: Nicholas Kaiser and Joseph Silk**, revolutionized cosmology with contributions to two of its vital components: dark matter and relic radiation from the Big Bang
- **2018: The Planck Team, Jean-Loup Puget and Nazzareno Mandolesi**, for measuring the universe's contents and the geometry and test inflation with unparalleled precision
- **2017: Sandra M. Faber**, for a body of work that has helped establish many of the foundational principles underlying the modern understanding of the universe on the largest scales
- **2016: Rainer Weiss, Kip Thorne, Ronald Drever, and the entire LIGO team**, for a first detection of gravitational waves that emanated from the collision of two black holes
- **2015: John Carlstrom, Jeremiah Ostriker, and Lyman Page**, for their individual and collective contributions to the study of the universe on the largest scales
- **2014: Jaan Einasto, Kenneth Freeman, Brent Tully and Sidney van den Bergh**, for pioneering contributions to the understanding of the structure and composition of the nearby Universe
- **2013: Viatcheslav Mukhanov and Alexei Starobinsky**, for contributions to inflationary cosmology and the theory of inflationary perturbations of the metric, which changed our views on the origin of our universe and on the mechanism of formation of its structure
- **2012: Charles Bennett and the WMAP Team**, for their exquisite measurements of anisotropies in the relic radiation from the Big Bang---the Cosmic Microwave Background
- **2011: Marc Davis, George Efstathiou, Carlos Frenk, Simon White**, pioneering use of numerical simulations to model and interpret the large-scale distribution of matter in the Universe
- **2010: Charles Steidel**, for his groundbreaking studies of the distant Universe
- **2009: Wendy Freedman, Robert Kennicutt and Jeremy Mould**, for the definitive measurement of the rate of expansion of the universe, Hubble's Constant
- **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

The International Astronomical Union partners with the Foundation on the Prize and nominates the members of the Selection Advisory Board that chooses the Prize recipients. Its members are:

**Jeremy Butterfield**, University of Cambridge; **Paul Ho**, Institute of Astronomy and Astrophysics, Academia Sinica; **Angela Olinto** (Chair), The University of Chicago; **Jean-Loup Puget**, The National Centre for Scientific Research (CNRS); **Hans Ringström**, KTH Royal Institute of Technology; **Linda Tacconi**, Max Planck Institute for Extraterrestrial Physics; **Licia Verde**, Universitat de Barcelona. **Wendy Freedman** of The University of Chicago and **Martin Rees** of The University of Cambridge also serve as special Cosmology advisors to the Foundation.

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The Gruber International Prize Program honors individuals in the fields of Cosmology, Genetics and Neuroscience, whose groundbreaking 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 and potentially have a profound impact on our lives.

The Gruber Foundation was established in 1993 by the late Peter Gruber and his wife Patricia Gruber. The Foundation began its International Prize Program in 2000, with the inaugural Cosmology Prize.

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For more information on the Gruber Prizes, visit [www.gruber.yale.edu](http://www.gruber.yale.edu), e-mail [info@gruber.yale.edu](mailto:info@gruber.yale.edu) or contact A. Sarah Hreha at +1 (203) 432-6231. By mail: The Gruber Foundation, Yale University, Office of International Affairs, PO Box 208320, New Haven, CT 06520.

Media materials and additional background information on the Gruber Prizes are in our online newsroom: [www.gruber.yale.edu/news-media](http://www.gruber.yale.edu/news-media)

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