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## Is There a Crisis in Cosmology?

### A New Debate Over the Value of $H_0$



### *The 11<sup>th</sup> Madan Lal Mehta Lecture*

by

## PROFESSOR WENDY L. FREEDMAN

UNIVERSITY OF CHICAGO

Friday, December 4, 2020 at 10:00 am

Venue - Zoom

Live Webcast - <https://youtu.be/Hc-qrGhuwUI>

The Hubble constant, or current expansion rate of the universe ( $H_0$ ), sets the size and age scale for the universe. Since Edwin Hubble's discovery of the expansion in 1929, astronomers have developed increasingly precise techniques for measuring this parameter, using telescopes both on Earth and in space. An early program of the Hubble Space Telescope, led by Professor Freedman, was a Key Project to measure  $H_0$ , using Cepheid variables to calibrate the extragalactic distance scale. In 2001 the Key Project resolved a factor-of-two debate (over whether  $H_0$  was 50 or 100 km s<sup>-1</sup> Megaparsecs<sup>-1</sup>), and yielded a value of  $H_0 = 72$  with an uncertainty of 10%. The value of the Hubble constant measured using Cepheid variables and supernovae has remained stable (in the low to mid-70s) for about two decades, but the precision of the measurements has increased significantly. However, as the measurements have improved, a tension has arisen between the value inferred from measurement of the cosmic background radiation (assuming the current standard cosmological model), and those measured locally. If the tension is real, it may be signaling new physics beyond the standard model. In this lecture, Professor Freedman will describe recent advances in the field, and prospects for settling this new debate over the value of  $H_0$ .



Wendy Freedman is John and Marion Sullivan University Professor of Astronomy and Astrophysics at University of Chicago. She served as the Crawford H. Greenewalt Director of the Carnegie Observatories in Pasadena, California from 2003 to 2014. Her principle research interests are in observational cosmology. She was a principle investigator for a team of thirty astronomers who carried out the Hubble Key Project to measure the current expansion rate of the Universe. Her current research interests are directed at measuring both the current and past expansion rate of the universe. She is the Principal Investigator of a long-term program with the Hubble and Spitzer Space Telescopes to measure the Hubble constant to an accuracy of 3%. Her awards and honors include Dannie Heineman Prize for Astrophysics (2016), Gruber Cosmology Prize (2009), the Magellanic prize (2002), John P. McGovern Award (2000), and Marc Aaronson Lectureship and Prize (1994). She is an elected member of the National Academy of Sciences (US) and American Philosophical Society. She was elected fellow of the American Academy of Arts and Science (2000), fellow of the American Physical Society (2011), and legacy fellow of the American Astronomical Society (2020).

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