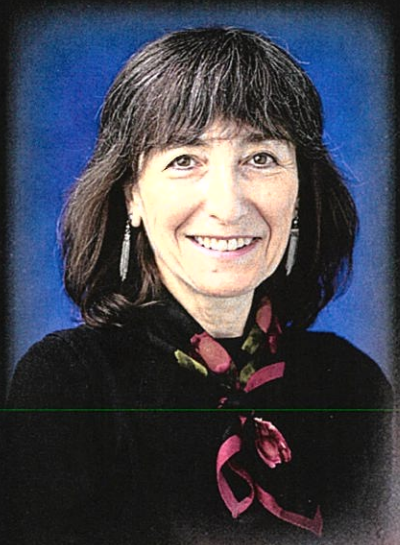
The Department of Physics at Cornell University and the College of Arts & Sciences Present

The Bethe Lectures



Wendy L. Freedman
John and Marion Sullivan University Professor of Astronomy and Astrophysics and the College

The University of Chicago

Physics Colloquium
The Hubble Tension: Is There a Crisis in Cosmology?
Schwartz Auditorium, Rockefeller Hall
Monday, March 20, 2023, 4:00 pm

LEPP Joint Seminar
Measuring the Hubble Constant: Stress-Testing the Standard Cosmological Model
700 Clark Hall
Tuesday, March 21, 2023, 4:00 pm

Public Lecture
How Fast is the Universe Expanding?
Schwartz Auditorium, Rockefeller Hall
Wednesday, March 22, 2023, 7:30 pm

Cornell Video Livestream at:
https://www.cornell.edu/video/wendy-freedman-2023

For further information, contact:
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If you need accommodations to participate in this event, please contact Sue Sullivan at sfc1@cornell.edu asap.

The Bethe Lectures

WENDY L. FREEDMAN

John and Marion Sullivan University Professor of Astronomy and Astrophysics and the College
The University of Chicago

THE HUBBLE TENSION: IS THERE A CRISIS IN COSMOLOGY?

Physics Colloquium, Monday, March 20, 2023, 4:00 pm

Schwartz Auditorium, Rockefeller Hall

The question of whether there is new physics beyond our current standard model, Lambda Cold Dark Matter (LCDM), is a crucial unresolved issue in cosmology today. Recent measurements of the Hubble constant (Ho) using Cepheids and Type Ia supernovae (SNe) appear to differ significantly (5-sigma) from values inferred from the cosmic microwave background (CMB) fluctuations. This discrepancy, if real, could indicate new physics beyond the standard model. In this talk, I will present results using data from the Hubble Space Telescope Advanced Camera for Surveys to independently calibrate SNe Ho using the Tip of the Red Giant Branch (TRGB) method. The TRGB, a marker of the core helium flash in low-mass stars, provides a highly precise and accurate standard candle. Additionally, the TRGB method is less affected by dust, metallicity, and crowding/blending compared to Cepheid variable stars. Finally, I will describe a new program using the James Webb Space Telescope aimed at reducing uncertainties in extragalactic distances and the measurement of Ho, and present some very new, preliminary results.

MEASURING THE HUBBLE CONSTANT: STRESS-TESTING THE STANDARD COSMOLOGICAL MODEL

LEPP Joint Seminar, Tuesday, March 21, 2023, 4:00 pm

700 Clark Hall

Many possible explanations have been put forward to explain the apparent 5-sigma discrepancy between the local measure of the Hubble constant (Ho) and that inferred from measurements of the cosmic microwave background (CMB). These include variation of the dark energy with redshift, early dark energy (before recombination), modifications to gravity, new particles or fields beyond the standard model. Yet to date, no convincing physical explanation for the Hubble constant tension has been found. The local Hubble constant measurements giving rise to the discrepancy are based on a calibration using Cepheid variable stars, and tying into Type Ia supernovae and give a value of Ho=73 km/s/Mpc. Adopting the standard Lambda Cold Dark Matter model, the measurements of temperature and polarization of the CMB yield a value of 67 km/s/Mpc. How serious is the current discrepancy? What are the limitations to the current measurements? How can the issue be resolved? Both Hubble Space Telescope, as well as new James Webb Space Telescope data, will be presented that are shedding new light on the issue.

HOW FAST IS THE UNIVERSE EXPANDING?

Public Lecture, Wednesday, March 22, 2023, 7:30 pm

Schwartz Auditorium, Rockefeller Hall

In 1929 astronomer Edwin Hubble discovered a universe filled with galaxies, and even more incredibly, a universe in which the galaxies are participating in an overall expansion of space. The current rate of expansion, called the Hubble constant, is a measure of the age and size of the universe. It has remained an exceedingly difficult quantity to measure accurately, and decades of effort have led to intense debates about its value. Recently, a new debate has emerged about the Hubble constant, potentially calling into question the standard model of cosmology. For the past 20 years, astronomers have observed the entire universe to be expanding at an increasing rate, pulled apart by a cosmic force, unexplained by any of our current physical theories. Could there be more exotic physics yet to be uncovered? I will describe the current state of cosmology and my work with the Hubble Space Telescope that has led to some of the most precise measurements of the Hubble constant made to date. I will also present some new data from the recently launched James Webb Space Telescope that promises to resolve many of the issues currently confronting these measurements.