

Dr. Perry Phillips, Herman Lectures, Part 1, 6-Minute Video Overview

Biblicalelearning.org by Ted Hildebrandt

In the Hubble Ultra Deep Field, nearly every point of light is an entire galaxy, containing billions of stars spanning billions of light-years. The Hot Big Bang model provides the scientific framework for this vastness. It is the leading explanation for the origin of the cosmos, supported by three observable pillars of physical evidence.

The first, and most foundational, is that the universe is expanding. Observational data show distant galaxies receding from Earth at high velocities. These objects appear to be in motion, yet they remain stationary relative to their local environment.

The physical fabric of spacetime is stretching. As the volume of empty space between galaxies grows, it carries them apart like markers on a ruler. Tracing this phenomenon requires an analysis of the raw spectrographic data that first allowed astronomers to model the geometry of a growing universe.

Distinguishing between an object moving through space and the expansion of space itself provides the key for modeling the history of the cosmos. In 1912, Vesto Slipher analyzed the light emitted by distant galaxies to calculate their rotation. Slipher utilized the Doppler effect to measure velocity.

When a wave source moves, the waves ahead of it compress, while the waves trailing behind stretch out. This principle applies directly to light. If an object moves away from the observer, its light waves stretch into longer, redder wavelengths.

In a spectrographic readout, these vertical emission lines shift distinctly toward the red end of the spectrum. Slipher's measurements revealed that almost every galaxy he observed exhibited this redshift, indicating they were all receding from Earth. Andromeda is a rare exception to this universal trend.

Andromeda exhibits a blue shift because it is close enough for local gravity to overpower the background expansion of space. It is actively moving toward the Milky Way. While gravity binds local clusters, the redshift observed beyond 250 million light-years confirms that cosmic scale expansion dictates the movement of the wider universe.

Edwin Hubble expanded on these findings in the late 1920s by combining Slipher's redshift data with precise distance measurements. By mapping distance against recession velocity on a coordinate graph, Hubble looked for a mathematical relationship in the movement of galaxies. As the data points populated the graph, a clear correlation emerged.

The linear trend established Hubble's law, a mathematical proof of the relationship between distance and speed in the cosmos. The data show that the farther a galaxy is from Earth, the faster it recedes. This law allows astronomers to calculate the exact distance of a newly discovered galaxy, simply by measuring its redshift and applying it to the established trendline.

Hubble's linear graph provided the metric needed to measure the volume of the observable universe. Hubble's data is often misinterpreted as evidence of a localized explosion of matter into an empty void. A more accurate model is a cross-section of expanding dough.

The raisins separate because the dough itself is swelling. The raisins do not travel through the dough. The dough carries them.

Raisins that start further apart separate at a faster rate as more dough generates between them, which explains why the recession speed of galaxies increases with distance. An inflating balloon provides a model for the lack of a central starting point. The galaxies are like dots on its surface as it fills with air.

From the perspective of any single dot, every other dot appears to be moving away. This is metric expansion. Spacetime generates new space between objects, pulling galaxies apart without them possessing their own kinematic motion.

This geometric expansion creates a physical threshold called the cosmic horizon. Spacetime can expand faster than the speed of light. Distant galaxies are eventually pulled past a point where the light they emit can no longer reach an observer on Earth.

Because the universe lacks a center or an edge, every point in the center of the expansion is called itself. If the universe is expanding at a measurable rate, we can run the clock in reverse to find its origin. Moving backward in time, galaxies move closer together, and the density of the universe increases.

The temperature rises until the observable universe compresses into a single point of intense energy. This calculation points to an origin point approximately 13.8 billion years ago. Physics cannot yet calculate back to an infinite singularity.

General relativity and quantum mechanics only allow us to model the universe as far back as the Planck Epoch, immediately after the expansion began. The Big Bang represents the beginning of spacetime itself, rather than an explosion of matter into space. Classic physics suggested that the gravitational pull of matter would eventually slow the expansion of the universe.

This graph illustrates three potential outcomes: a big crunch caused by collapse, a flat critical balance, or a slow, coasting expansion. Data from the 1990s showed none of these predictions were correct. The rate of expansion is increasing, represented by this fourth, upward-curving trajectory.

This shocking discovery revived a discarded concept from Albert Einstein's early work. To force his equations to describe a static universe, Einstein added a mathematical parameter called the cosmological constant, or λ . Though Einstein later rejected the constant, modern cosmologists have reintroduced it to represent dark energy, the unknown force driving the current acceleration of the universe.

The mathematical constant Einstein intended to fix a static universe is now the primary tool used to model its accelerating expansion. Modern astrophysics mirrors some of the

linguistic patterns found in ancient observations of the night sky. The biblical books of Job and Isaiah utilize specific Hebrew verbs to describe the architecture of the cosmos.

These texts describe the stretching of the heavens, like a tent or a curtain. This specific imagery of a spread-out fabric provides a notable linguistic bridge to our modern concept of metric expansion. This use of a stretched heaven indicates that the concept of an expanding cosmos has occupied the human inquiry into the stars for thousands of years.