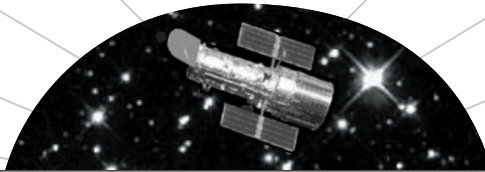




# THE STAR WITNESS



A PUBLICATION OF NASA'S "AMAZING SPACE" EDUCATION PROGRAM

## Special Feature

# Albert Einstein: A Genius, Relatively Speaking

By NASA's Amazing Space reporters  
September 2006

**A**LBERT EINSTEIN (1879-1955) was one of the greatest scientists of the 20th century, an era dominated by science. His theories about how the world works transformed our understanding of the universe. Even as a young child, Einstein was thinking about the world in a way that was different from other children. A toy compass given to Einstein by his father inspired the future scientist. The five-year-old wondered what made the needle always point north.

A creative mind and a love for mathematics and physics inspired the German-born Einstein to become a scientist. However, it was not as a celebrated scientist that Einstein proposed his first groundbreaking theories.

In 1905, when he was 26 years old, Einstein worked as a clerk at the Patent Office in Bern, Switzerland. In his spare time, he wrote and then

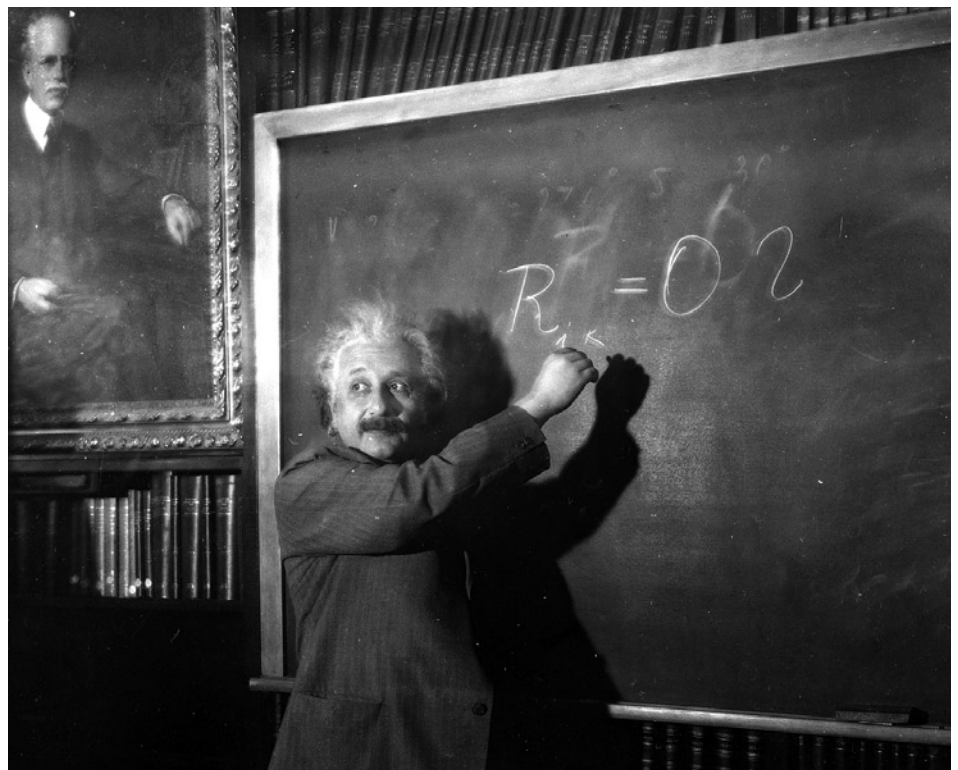


IMAGE: Courtesy Huntington Library

**Albert Einstein** is shown giving a talk at the Carnegie Institution of Washington, in Pasadena, California (photo date: approximately 1931).

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submitted a series of five scientific papers to a leading German physics journal. This alone was remarkable, as scientists usually submit a couple of papers a year, working on them full time. In addition, three of these papers were revolutionary, providing the foundation for modern physics.

### **Transforming physics**

Einstein's first paper used mathematics to explain the motion of particles in a liquid or gas, such as dust particles moving in air. In another paper, Einstein explained how light can be transformed into electricity. He won the 1921 Nobel Prize in Physics for this explanation.

In his third paper, he described the complicated Special Theory of Relativity. This theory explains how measurements change when you travel very fast — almost as fast as light travels. To mark the 100th anniversary of these achievements, 2005 was designated by the United Nations as the International Year of Physics, also known as the Einstein year.

### **Great minds think alike**

In later years, Einstein developed his General Theory of Relativity, which explains how gravity works for very massive objects like black holes. The equations also indicated that the universe should be either expanding or collapsing. However, Einstein observed that stars do not appear to move away from or toward each other, and he rejected that prediction. He added a factor to his theory to make the universe motionless.

A few years later, astronomer Edwin Hubble, for whom the Hubble Space Telescope is named, became famous for showing that galaxies existed

outside our Milky Way Galaxy. He also showed that the farther away a galaxy is from Earth, the faster it appeared to be moving away. Hubble was the first to explain that this observation meant the universe was expanding.

When Einstein learned of Hubble's work, he realized his theory had correctly predicted the universe's expansion. He considered his disbelief of his own theory the greatest blunder of his life. Scientists now have proven Einstein's General Theory of Relativity, and use it, along with new telescope technology, to help them discover more about the expanding universe.

### **Legacy of a genius**

If the universe is expanding today, then it must have been smaller in the past. In fact, the universe must have a beginning. If scientists can figure out how fast the universe is expanding, they can work backward to find out how long the universe has been expanding. This calculation yields the age of the universe and answers several of the basic questions we have concerning where we came from and how we got here.

Before the Hubble Space Telescope was launched, estimates for the universe's age ranged between 10 and 20 billion years old. One of the three primary scientific goals of the Hubble mission is to determine the expansion rate, and thus the age, of the universe. In 1999, astronomers used the Hubble Space Telescope to narrow down the age of universe to between 10 and 14 billion years old. Further studies with Hubble and other telescopes yielded an age of about 13.7 billion years old.

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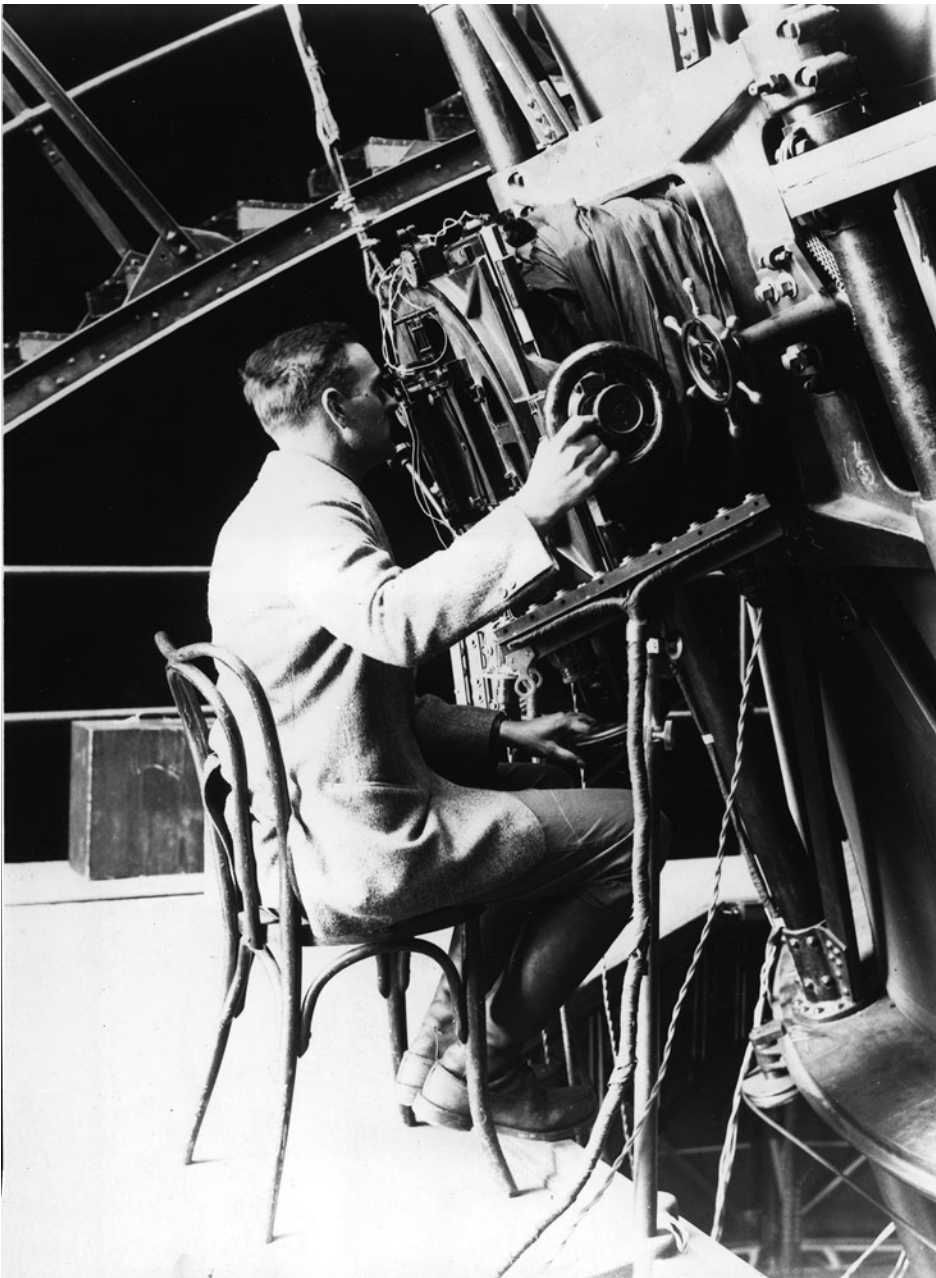


IMAGE: Courtesy Huntington Library

**Edwin Hubble** is shown looking through the 100-inch telescope at the Mt. Wilson Observatory (photo date: approximately 1922). With this telescope, Hubble showed that galaxies exist outside our own galaxy.

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These results, and many of the groundbreaking discoveries of the last century, still rely upon Einstein's work. His ideas have provided a solid and stable framework upon which much of our knowledge of the universe is built. ★

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