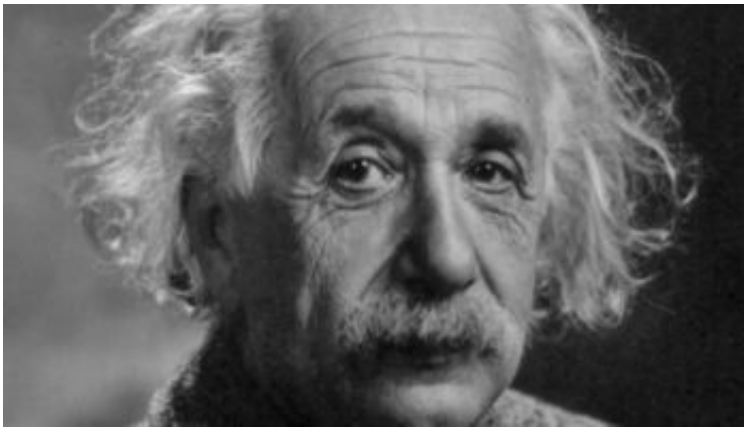


Quest to settle riddle over Einstein's theory may soon be over

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Albert Einstein

Astronomy experiments could soon test an idea developed by Albert Einstein almost exactly a century ago, scientists say.

Tests using advanced technology could resolve a longstanding puzzle over what is driving the [accelerated expansion](#) of the Universe.

Researchers have long sought to determine how the Universe's accelerated expansion is being driven. Calculations in a new study could help to explain whether dark energy- as required by Einstein's theory of general relativity - or a revised theory of gravity are responsible.

Einstein's theory, which describes gravity as distortions of space and

time, included a mathematical element known as a Cosmological Constant. Einstein originally introduced it to explain a static universe, but discarded his mathematical factor as a blunder after it was discovered that our Universe is expanding.

Research carried out two decades ago, however, showed that this expansion is accelerating, which suggests that Einstein's Constant may still have a part to play in accounting for dark energy. Without dark energy, the acceleration implies a failure of Einstein's theory of gravity across the largest distances in our Universe.

Scientists from the University of Edinburgh have discovered that the puzzle could be resolved by determining the speed of gravity in the cosmos from a study of [gravitational waves](#) -space-time ripples propagating through the [universe](#).

The researchers' calculations show that if gravitational waves are found to travel at the speed of light, this would rule out alternative gravity theories, with no [dark energy](#), in support of Einstein's Cosmological Constant. If however, their speed differs from that of light, then Einstein's theory must be revised.

Such an experiment could be carried out by the Laser Interferometer Gravitational-Wave Observatory (LIGO) in the US, whose twin detectors, 2000 miles apart, directly detected gravitational waves for the first time in 2015.

Experiments at the facilities planned for this year could resolve the question in time for the 100th anniversary of Einstein's Constant.

The study, published in *Physics Letters B*, was supported by the UK Science Technology Facilities Council, the Swiss National Science Foundation, and the Portuguese Foundation of Science and Technology.

Dr Lucas Lombriser, of the University of Edinburgh's School of Physics and Astronomy, said: "Recent direct gravitational wave detection has opened up a new observational window to our Universe. Our results give an impression of how this will guide us in solving one of the most fundamental problems in physics."

More information: Lucas Lombriser et al, Challenges to self-acceleration in modified gravity from gravitational waves and large-scale structure, *Physics Letters B* (2017). [DOI: 10.1016/j.physletb.2016.12.048](https://doi.org/10.1016/j.physletb.2016.12.048)

Provided by University of Edinburgh

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