Centenary of cosmological constant lambda

July 11 2018

Physicists are now celebrating the 100th anniversary of the cosmological constant. On this occasion, two papers recently published in *EPJ H* highlight its role in modern physics and cosmology. Although the term was first introduced when the universe was thought to be static, today the cosmological constant has become the main candidate for representing the physical essence believed to be responsible for the accelerated expansion of our universe. Before becoming widely accepted, the cosmological constant was during decades the subject of many discussions about its necessity, its value and its physical essence. Today, there are still unresolved problems in understanding the deep physical nature of the phenomena associated with the cosmological constant.

In his paper, Bohdan Novosyadlyj, affiliated with the National University of Lviv, Ukraine, explains how Albert Einstein introduced the cosmological constant in 1917 to make the model of static Universe, then accepted by most scientists, work. Its deep physical meaning, however, escaped Einstein. Following the discovery of evidence for a non-static universe in 1929, Einstein regretted introducing this constant into equations of general relativity. Meanwhile, other scientists tried for decades to understand its physical meaning and establish its magnitude. When evidence of dark energy was observed by Michael Turner in 1998, scientists began to consider alternatives of cosmological constant to model that dark energy.

In another paper, Cormac O'Raifeartaigh from Waterford Institute of Technology, Ireland, and colleagues present a detailed analysis of the 100-year history of the cosmological constant. Starting with static

models of the universe, the paper explains how the constant became marginalised following the discovery of cosmic expansion. Subsequently, it was revived to address specific cosmic puzzles such as the timespan of expansion, the formation of galaxies and the red-shifts of quasars.

More recently, the constant has acquired greater physical meaning, as it has helped to the matching of further recent observations with theory. Specifically, it was helpful to reconcile current theory with the recently-observed phenomenon of dark energy as evidenced by the measurement of present cosmic expansion using the Hubble Space Telescope, the measurement of past expansion using supernova, and the measurement of cosmic microwave background by balloon and satellite.

More information: Bohdan Novosyadlyj, Century of Λ, *The European Physical Journal H* (2018). DOI: 10.1140/epjh/e2018-90007-y

Cormac O'Raifeartaigh et al. One hundred years of the cosmological constant: from "superfluous stunt" to dark energy, *The European Physical Journal H* (2018). DOI: 10.1140/epjh/e2017-80061-7