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The Path to the Constant

Content

Cosmological constant, now called the Dark Energy, was introduced by Einstein in his General Theory of Relativity. It had a checkered history, mostly declared to be unimportant, culminating with the Nobel Prize in Physics in 2011, and a general acceptance ever since. It is currently dominating the expansion rate of the Universe. Its nature is now considered to be one of the most outstanding problems of physics and cosmology, and its resolution will likely lead to a major change in physics, perhaps comparable to the General Relativity itself.

It was not always thus. Since its value could not be derived from the existing physics (just like any other fundamental physical constant), most physicists, and theorists in particular, simply declared it to be zero, while many observational astronomers thought that it should be measured, like any other cosmological parameter. This is a fascinating episode of the social psychology of science, reflecting both the groupthink and the subsequent acceptance when the actual measurements demonstrated its existence and importance. One aspect of this was its role in the Cosmic Inflation paradigm, which has been a generally accepted framework for cosmology since the early 1980s, despite the fact that it is based on an assumed, but as yet unknown physics of the early Universe.

While there have been sporadic claims about the cosmological constant detection and measurement over decades, compelling evidence was lacking, but circumstantial evidence was accumulating, and by the early 1990s, it was a subject seriously discussed in the extragalactic astronomy and community. The breakthrough happened in 1998, when physicists studying the Cosmic Microwave Background radiation, and two groups working of distant Supernovae, finally obtained convincing evidence, which was strengthened by many subsequent measurements.

In this talk, I will review some of the history of the relevant claims and the growing evidence, and the dramatic belief switch that followed the 1998 measurements. While there never was a compelling reason to reject the existence of the cosmological constant, the sudden change in its acceptance resembles a phase transition of beliefs.

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