

HERTZ LECTURE.

DESY Lecture on Physics 2024

Consensus and confusion in cosmology

Prof. Dr. Marc Kamionkowski
Johns Hopkins University



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DESY main auditorium
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Early Dark Energy can Resolve the Hubble Tension

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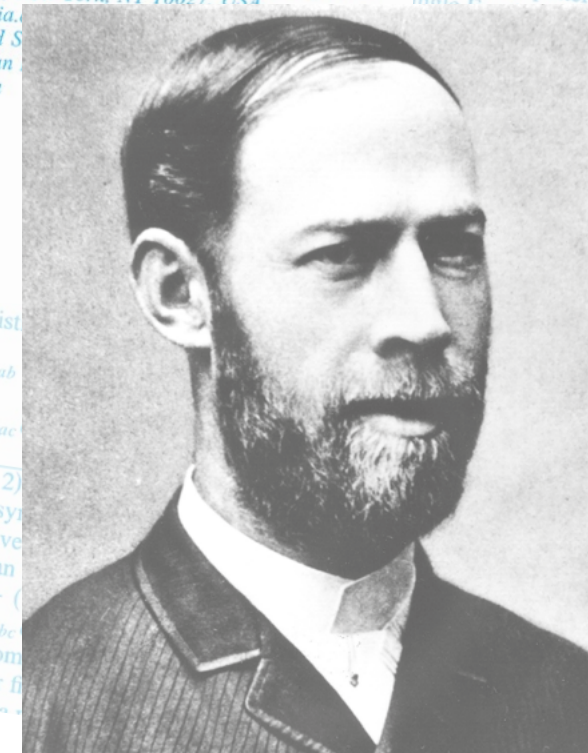
Early dark energy (EDE) that behaves like a cosmological constant at early times (redshift) and then dilutes away like radiation or faster at later times can solve the Hubble tension. In the sound horizon at decoupling is reduced resulting in a larger value of the Hubble parameter from the cosmic microwave background (CMB). We consider two physical models for EDE involving an oscillating scalar field and another a slowly rolling field. We perform a detailed evolution of perturbations in these models. A Markov Chain Monte Carlo search of the parameters for the EDE models, in conjunction with the standard cosmological parameters, identifies which H_0 inferred from *Planck* CMB data agrees with the SH0ES local measurement cosmologies, current baryon acoustic oscillation and supernova data are described as well as the cold dark matter model with a cosmological constant, while the fit to *Planck* data is slightly better. Future CMB and large-scale-structure surveys will further probe this scenario.

The past quarter century has been a period of rapid progress in our understanding of the origin and evolution of the Universe. We now have a simple mathematical model that can account for the gross features of our Universe as well as detailed information from precise measurements and observations. The model requires, though, several ingredients, such as dark matter and dark energy, that are not to be found within our current understanding of the fundamental laws of physics. There has also emerged, in the past few years, some inconsistencies between various measurements. In this talk, I will describe the triumphs of our current cosmological model, as well as its shortcomings.

SUPERSYMMETRIC DARK MATTER

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Heinrich Hertz
1857 Hamburg-Karlsruhe-Bonn 1894

A Probe of Primordial Gravity Waves and Vorticity

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