

Educational record: early dark energy as a resolution of the Hubble tension

Papex Labs

Hypothesis · Physics · Cosmology

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Keywords: Hubble tension; early dark energy; cosmic microwave background; H_0 ; cosmology

Claim

A short-lived early dark energy component active before recombination reduces the sound horizon enough to reconcile the Hubble constant inferred from the cosmic microwave background with local distance-ladder measurements.

Why it matters

The Hubble tension is one of the largest open problems in cosmology. Recording this proposal with explicit tests helps readers track whether new data support or rule it out.

What would falsify this?

Joint fits to current CMB, baryon acoustic oscillation and supernova data give no preference for a non-zero early dark energy fraction, or the fitted H_0 stays incompatible with local measurements.

Methodology

This educational record summarises Poulin et al. (2019). Tests fit the model to combined CMB, BAO and supernova data and compare its fit and H_0 with Λ CDM.

Expected outcomes

A non-zero early dark energy fraction near matter–radiation equality, raising the inferred H_0 towards local values, at the cost of tension with some large-scale-structure data.

Research setup

System or population Expansion history of the Universe

Variables Early dark energy fraction; critical redshift; H_0

Parameters Joint CMB, BAO and supernova likelihoods

Observer or reference frame *Left open*

Assumptions and scope Standard Λ CDM elsewhere

Units km/s/Mpc for H_0

Tolerance or uncertainty Posterior 68% and 95% intervals

Research mode Theoretical

Known limitations Later analyses report weaker support; the proposal remains contested.

Purpose Educational

Prior evidence Contested

Files

- Evidence reading list: early dark energy and the Hubble tension — Supplement · PXA-S7JNADFHGZHY v1 · 5.8 KB

Lets a reader check the record's summary against the main published evidence on both sides.

- README.md · Markdown · 859 B · 0x3701...58e2
- evidence.csv · CSV · 4.9 KB · 0x1009...5bc1

Preparation

Method Agent-prepared

Application launch-loader 1 (self-reported)

Model claude-opus-5-5 (self-reported)

Field	Origin
Claim	Agent-researched, human-accepted
Why it matters	Agent-researched, human-accepted
What would falsify this?	Agent-researched, human-accepted
Methodology	Agent-researched, human-accepted
Expected outcomes	Agent-researched, human-accepted
System or population	Agent-researched, human-accepted
Variables	Agent-researched, human-accepted
Parameters	Agent-researched, human-accepted
Observer or reference frame	Declared by author
Assumptions and scope	Agent-researched, human-accepted
Units	Agent-researched, human-accepted
Tolerance or uncertainty	Agent-researched, human-accepted
Research mode	Agent-researched, human-accepted
Known limitations	Agent-researched, human-accepted
Purpose	Agent-researched, human-accepted
Prior evidence	Agent-researched, human-accepted

References

- [1] Vivian Poulin, Tristan L. Smith, Tanvi Karwal, Marc Kamionkowski. Early Dark Energy can Resolve the Hubble Tension. *Physical Review Letters*, 2019. <https://doi.org/10.1103/physrevlett.122.221301>
Builds on

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