Relevance of on and off transitions in quantum pair production experiments

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IV IPARCOS Congress – 10th December 2025

Phys. Rev. D 112, 085028 (2025)

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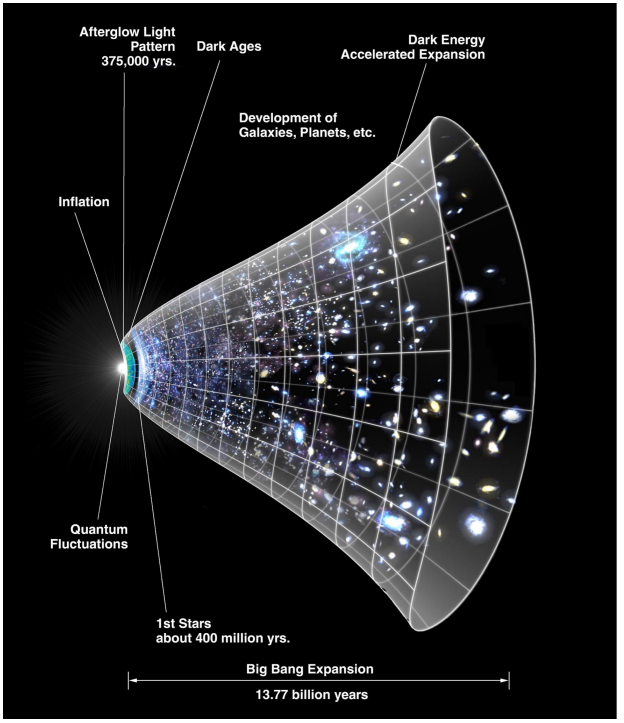


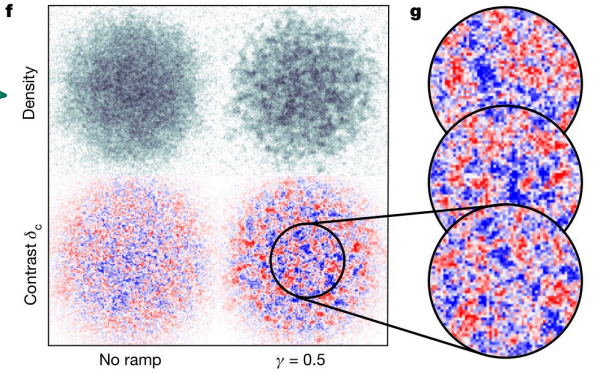
During the expansion of the Universe, particles are produced!

We would like to measure the production of particles due to the expansion between times η_{on} and η_{off}.

η : conformal time

There are experiments that simulate how little universes expand :

2D
Bose-Einstein
Condensate

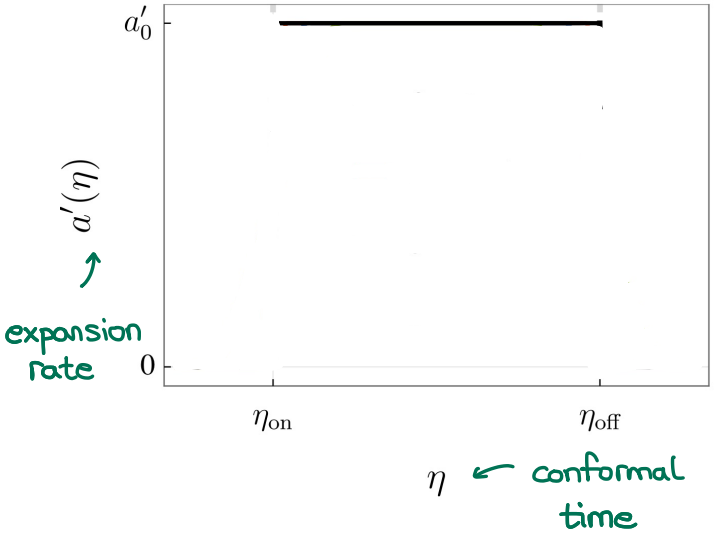


Nature 611, 260 (2022)

But we found that we might have some problems with their interpretation ...

Imagine an experiment simulating a universe expanding at constant rate:

OBJECTIVE: Particles produced between η_{on} and η_{off}?



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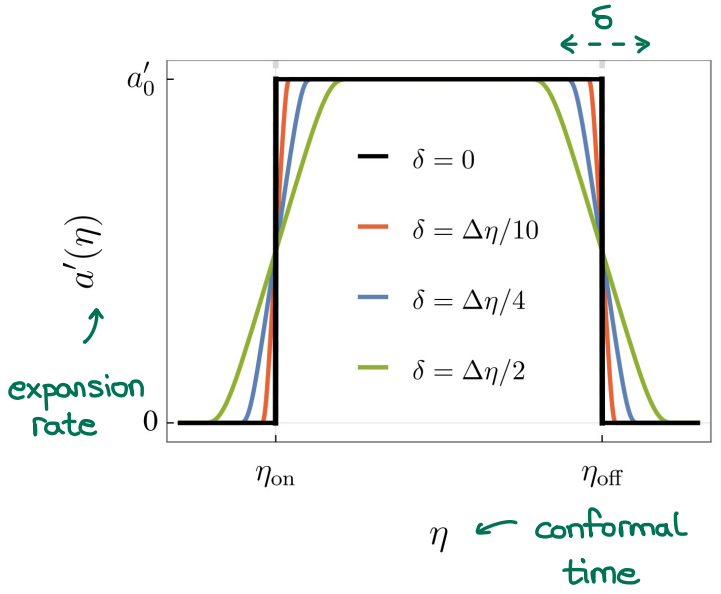
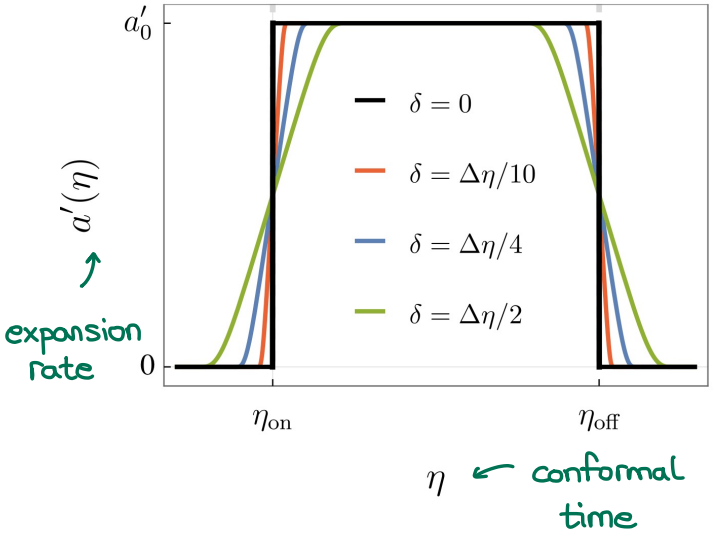


OBJECTIVE: Particles produced between $\eta_{\rm on}$ and $\eta_{\rm off}$?

However, one cannot avoid 'on' and 'off' transitions in the lab.

? How do 'on' and 'off' transitions impact the results of experiments?

We showed that particle spectra can be overwhelmingly dominated by 'on' and 'off' transitions.



BE CAREFUL WHEN INTERPRETING RESULTS OF EXPERIMENTS!

~~'We simulated an expanding universe at constant rate'.~~

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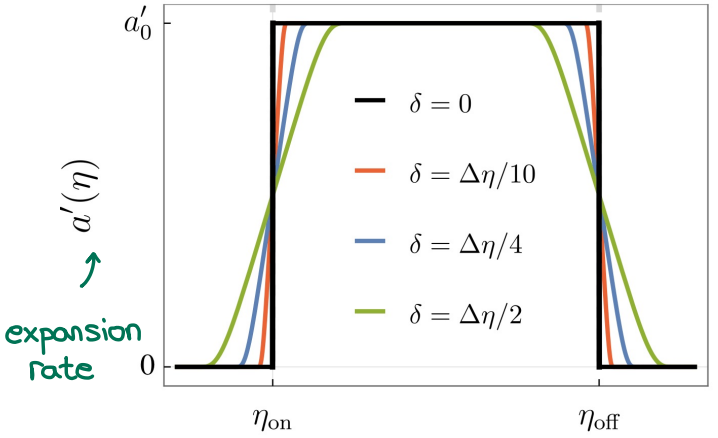


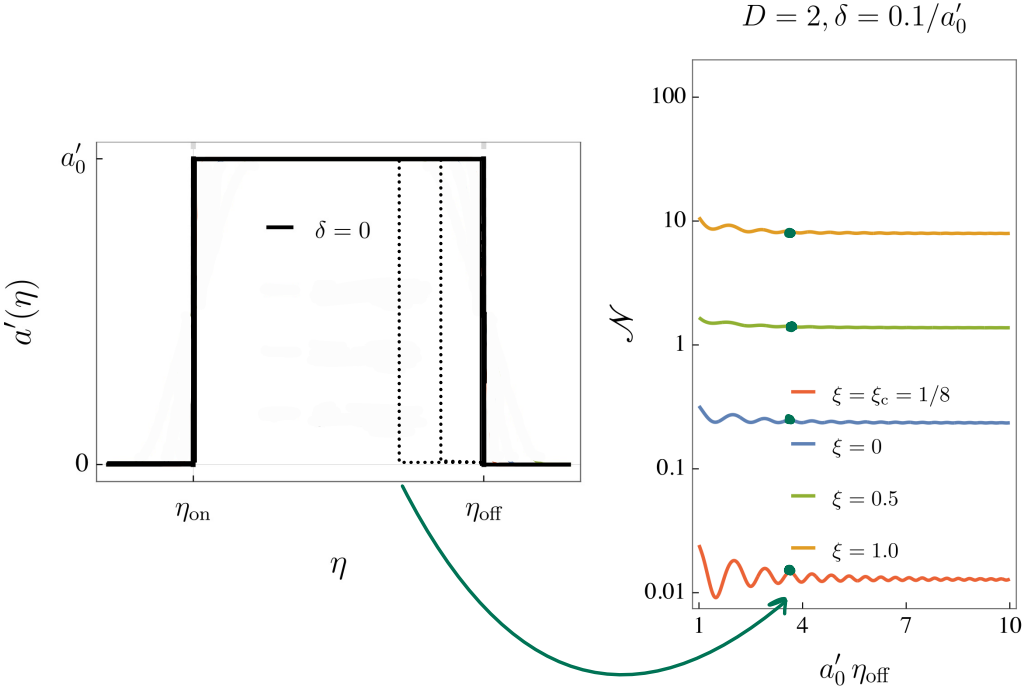
BE CAREFUL WHEN INTERPRETING RESULTS OF EXPERIMENTS!

'We simulated an expanding universe at constant rate'.

+ 'on' and 'off' transitions

and actually these contribute the most!

(1+2) – FLRW spacetime + neutral scalar field $\Phi(t,\vec{x})$



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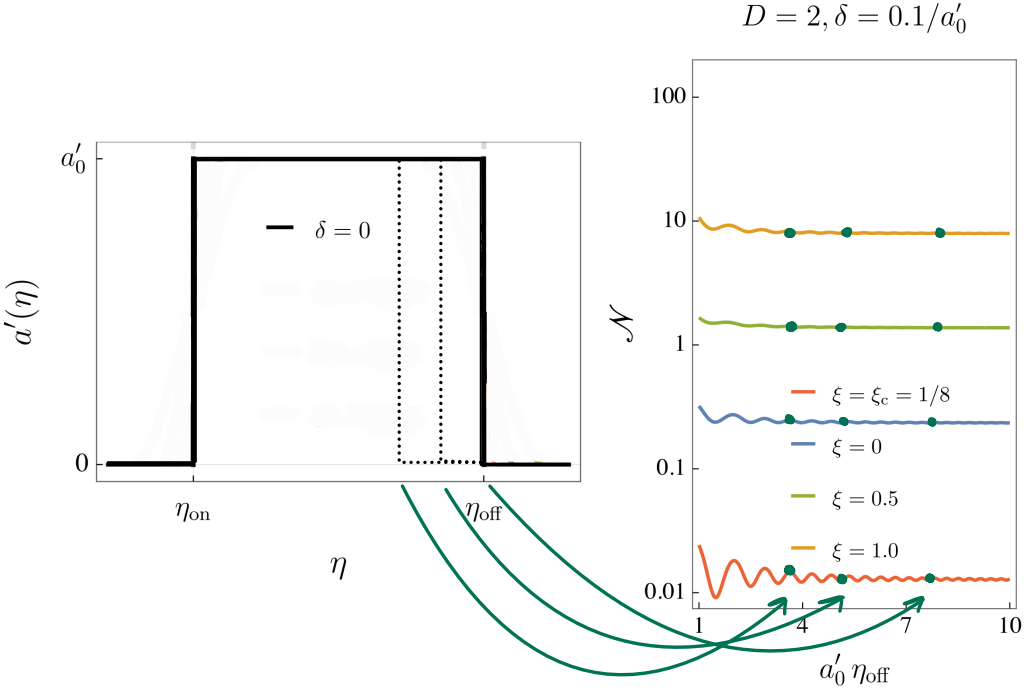

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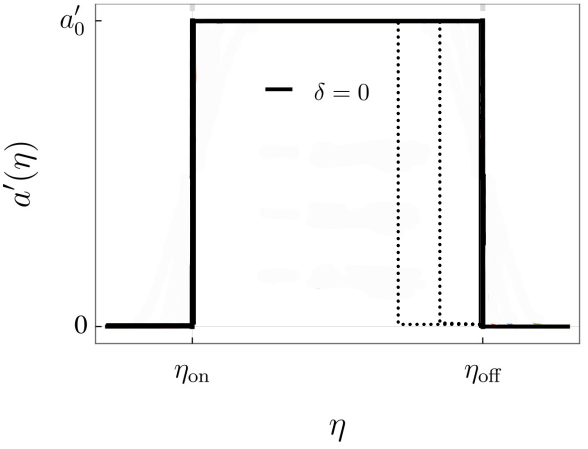

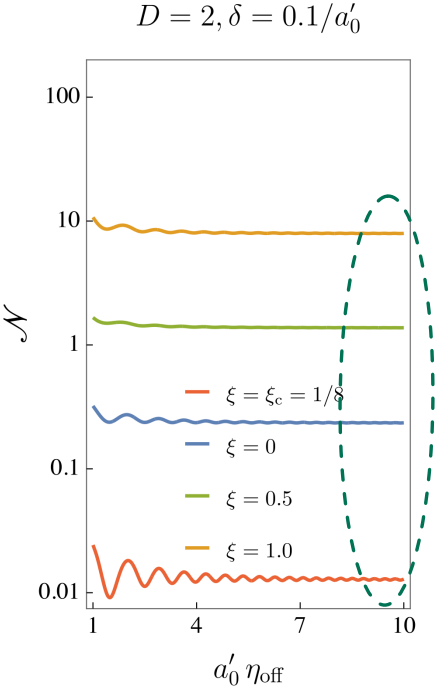

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Production stabilizer:

intermediate expansion contributes minimally to the overall production.

'On' and 'off' transitions dominate

particle creation in (some) analog gravity experiments that simulate an expanding cosmological universe.

Be careful with their interpretations!