



# Unwinding Inflation and Brane Dynamics



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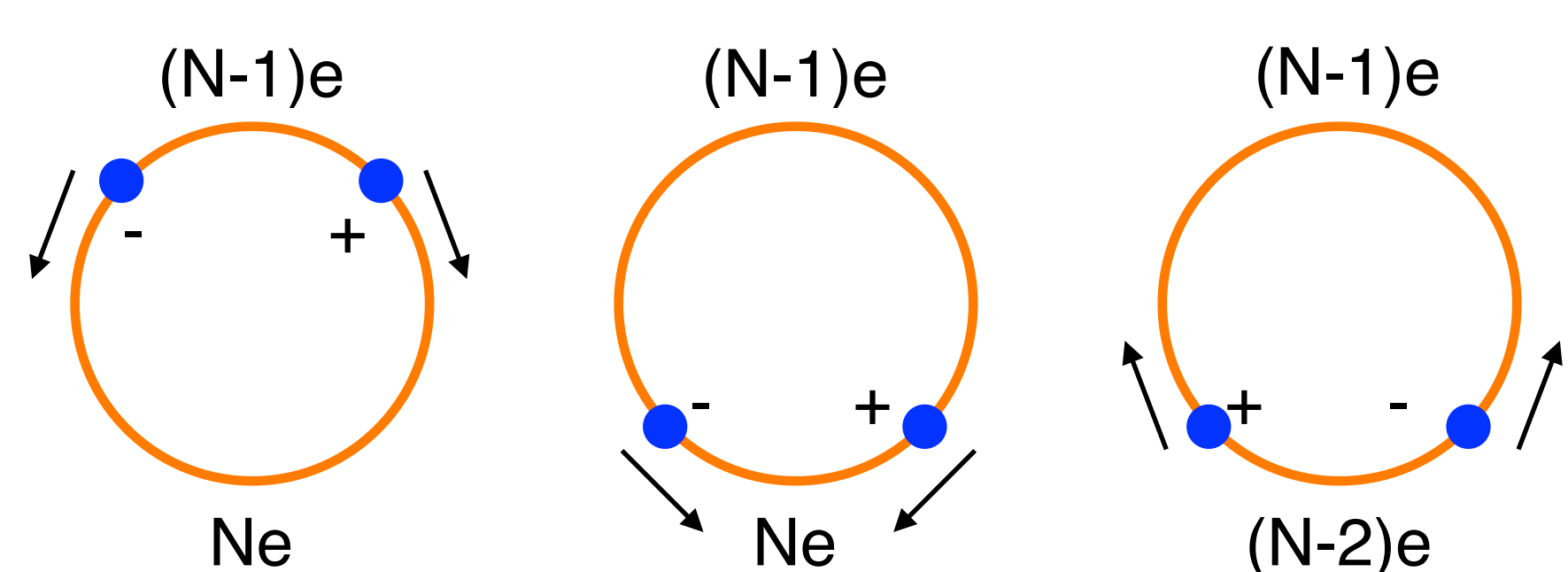
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## Problem

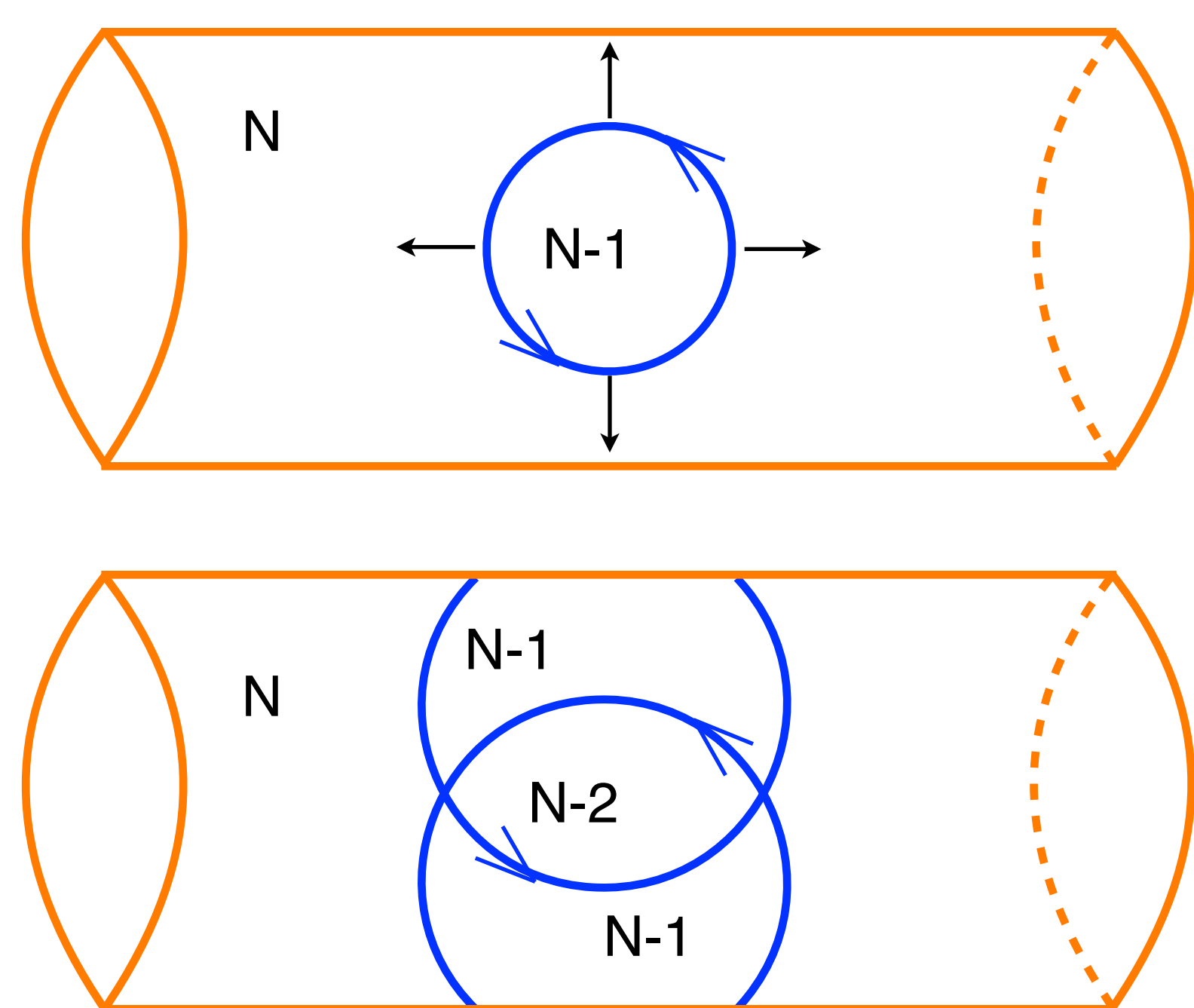
String theory predicts a landscape: can we exit False Vacuum Eternal Inflation to a slow roll phase?

## Idea

A top form flux sources a vacuum energy. A slow discharge would mimic slow roll. Example: Schwinger model on a circle



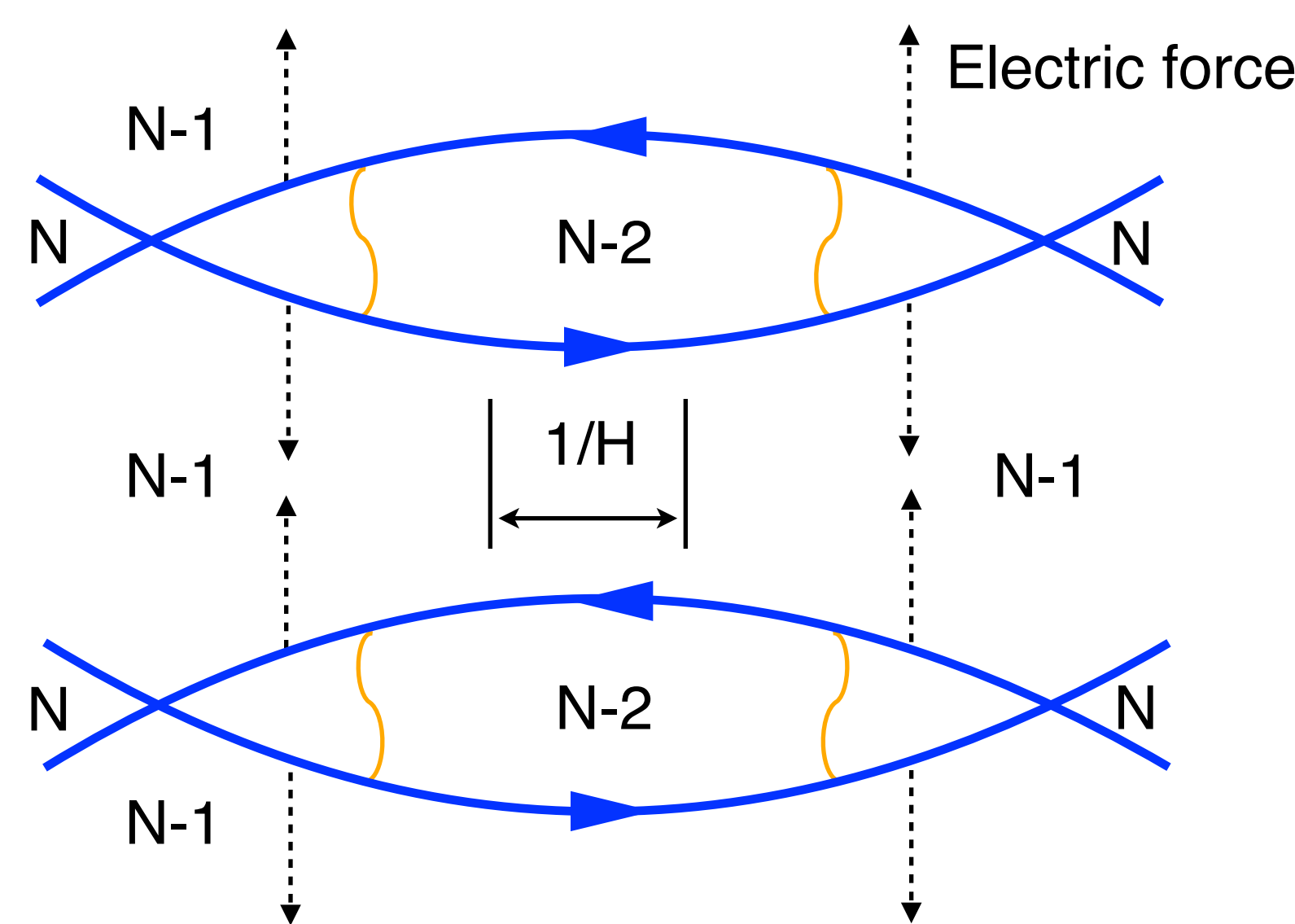
## Adding dimensions



dS<sub>4</sub>xM with a constant flux that wraps all dS. A bubble brane forms and starts expanding, colliding with itself and discharging the flux.

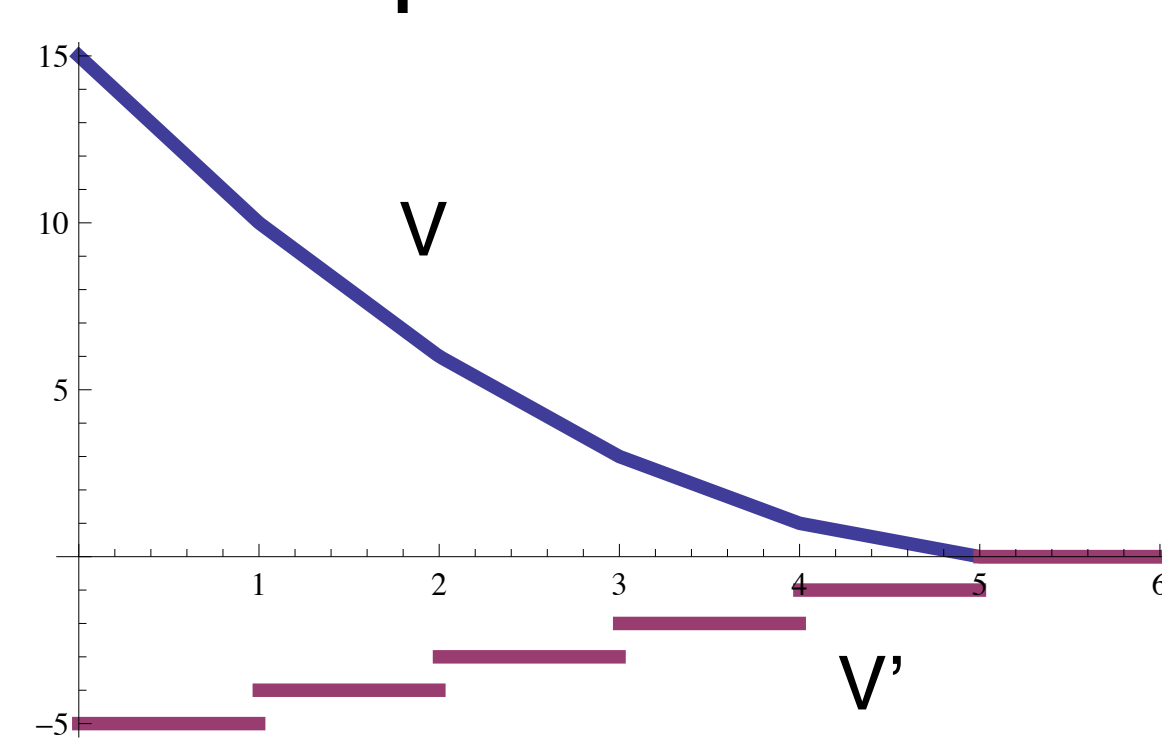
## Main mechanism

The branes move at approximate constant speed because of dS friction and after a few efolds the system can be treated as a brane colliding with an anti-brane



## Effective potential

In the case of one circular compact dimension, the effective 4D potential is piecewise linear and mimics a parabola.



## Power spectrum

The power spectrum receives two contributions:

- de Sitter perturbations
- Particles/String production

The latter is subdominant, but string productions influences the late time evolution and the end of inflation

## Reheating

Inflation ends when brane and anti-brane annihilate. The annulus diagram controls the rate of string production between moving branes, which contribute to stopping the branes. The branes will annihilate once they go slow enough to allow tachyon condensation

## Predictions

**Tensor-to-scalar ratio:** potentially observable in the near future and depends on the brane tension  $\sigma$  and velocity  $v$

$$r = 128\pi G_N \sigma v^2 / H^2$$

**Oscillations** in the power spectrum: strings are produced at each collision and they momentarily slow down the branes.

**Non-gaussianities:** the model has a non trivial speed of sound.

$$f_{NL}^{eq} \sim (1 - c_s^2) / c_s^2 \approx \gamma^2$$

## Future directions

**Compact dimensions:** full embedding in string theory with a proper compactification

**Reheating:** different units of flux might be discharged in different regions of the sky