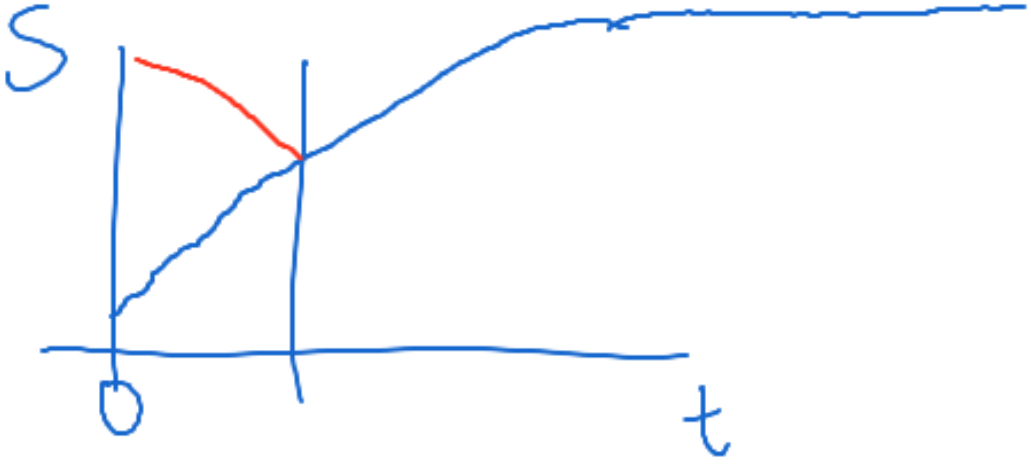
The origin of irreversibility:

cosmic initial state

(uniform hydrogen gas)



Boltzmann's fluctuation hypothesis

Wrong! Eddington (1931)

Feynman (1965)

Problem: smaller fluctuations are more frequent ~~likely~~

Boltzmann brains

"Copernican principle" (J. R. Gott)

"we should be typical observers in a typical universe".

You are not a Boltzmann brain.

The Past Hypothesis

2 types of laws :

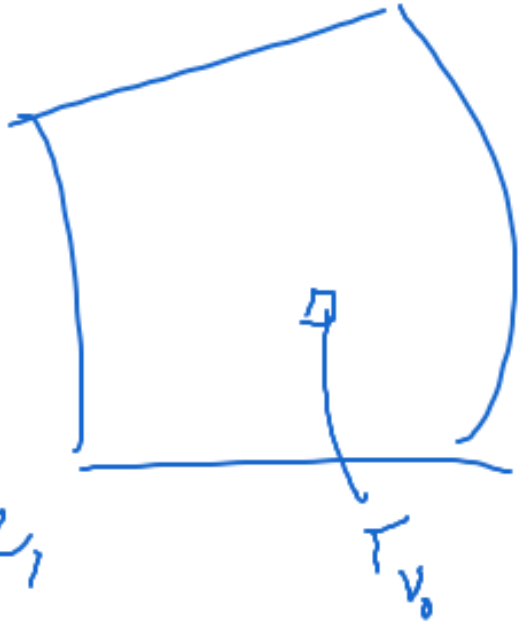
1) dynamical laws (time evolution)

2) initial laws.

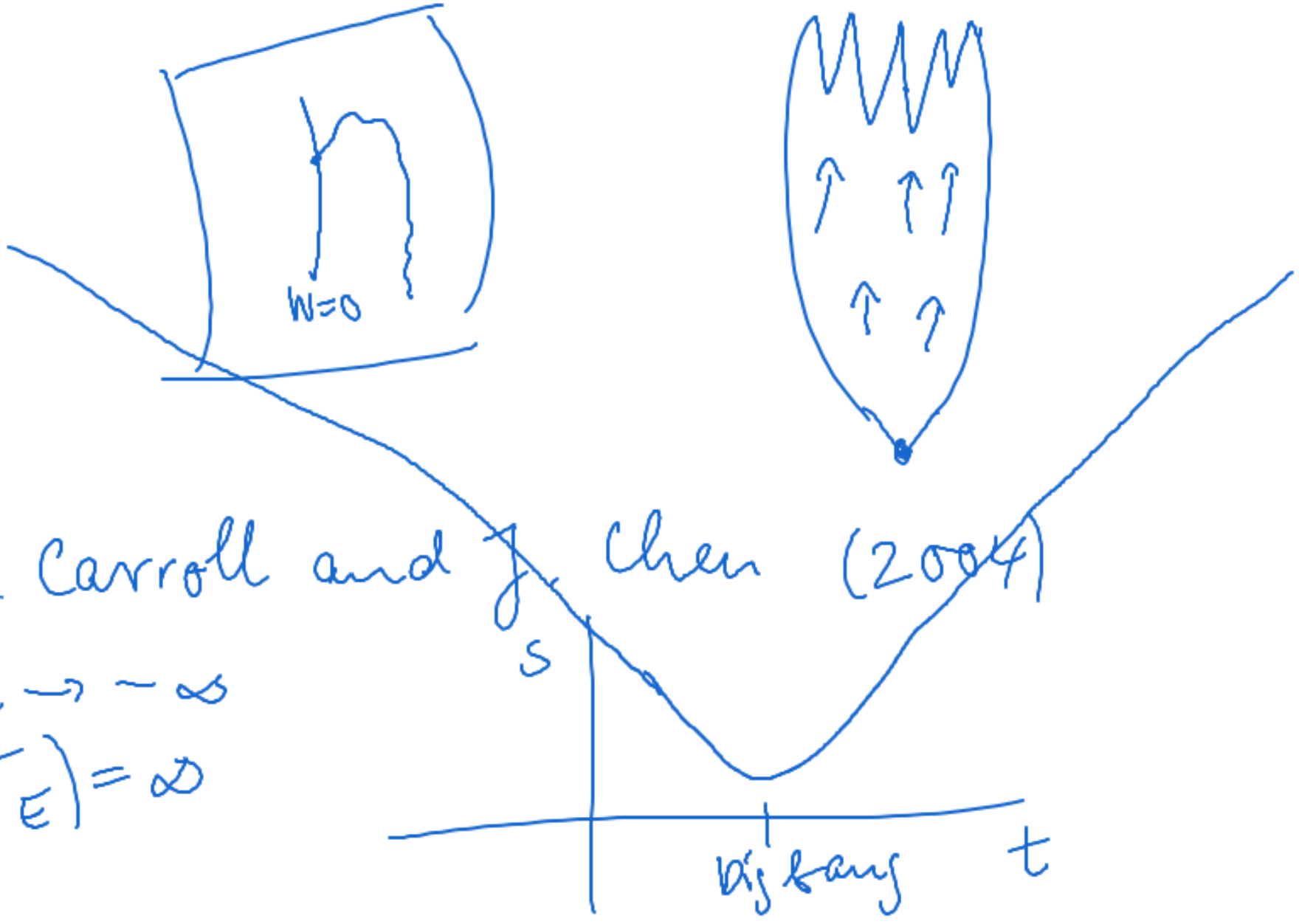
general relativity : space-time may have a initial singularity

Friedmann 1920s

2) boundary law



Proposal: (R. Penrose 1979)
Weyl curvature hypothesis:
At the singular ends of space-time, one of
Weyl curvature = 0.



S. Carroll and J. Chen (2004)

$t \to -\infty$

$\mu_E(\Gamma_E) = \infty$