

Title: Phases of eternal inflation

Date: Jun 15, 2010 05:15 PM

URL: <http://pirsa.org/10060014>

Abstract: TBA

On the Topological Phases of Eternal Inflation,
[Yasuhiro Sekino, Stephen Shenker, Leonard Susskind](#)

[arXiv:1003.1347](#)

How many kinds of Eternal Inflation are there?

Lots

PHASES OF ETERNAL INFLATION MODEL



rate varies.

No eternal inflation



Eternal Inflation

Eternal Inflation

No Eternal Inflation

Black Island

Tubular

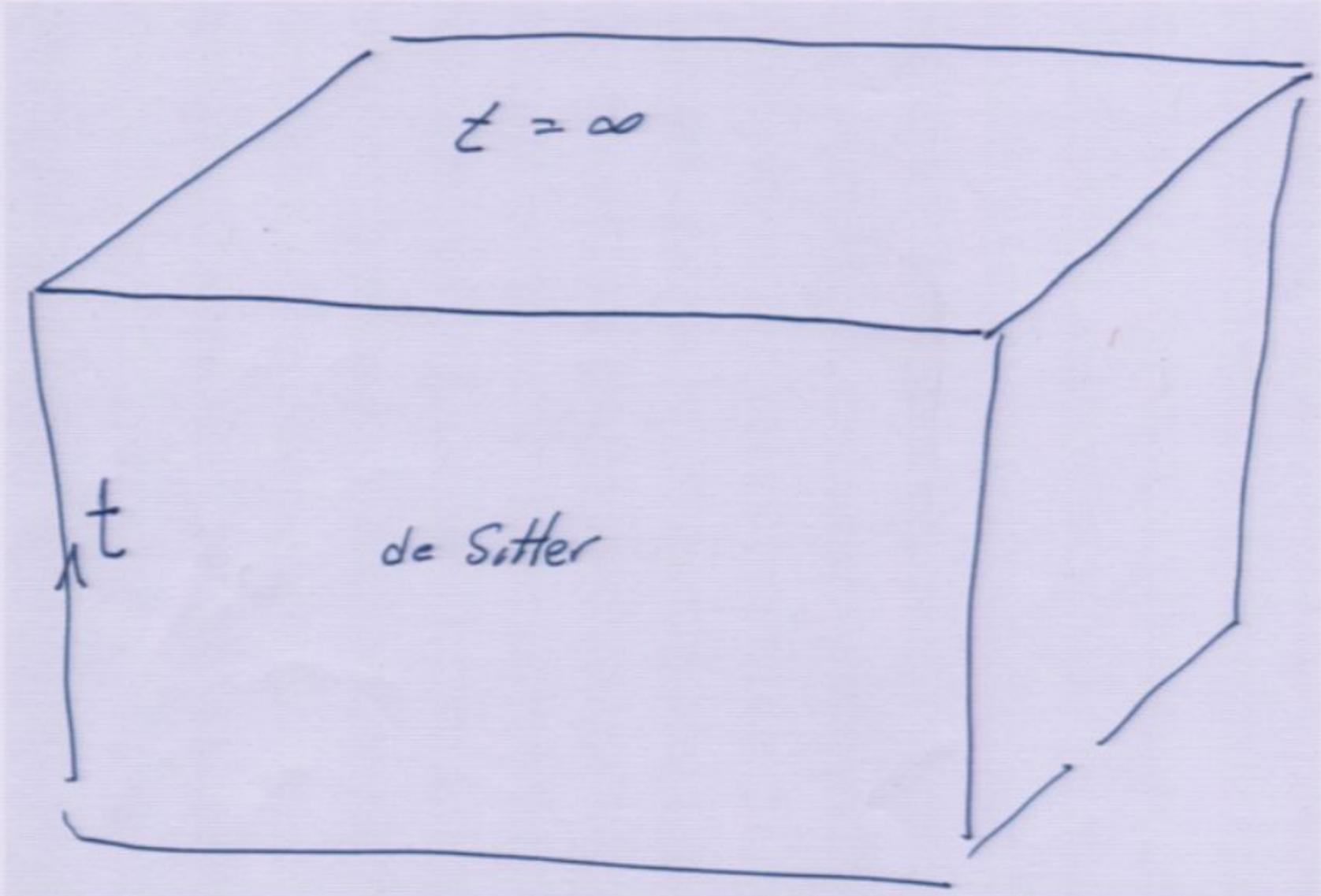
White Island

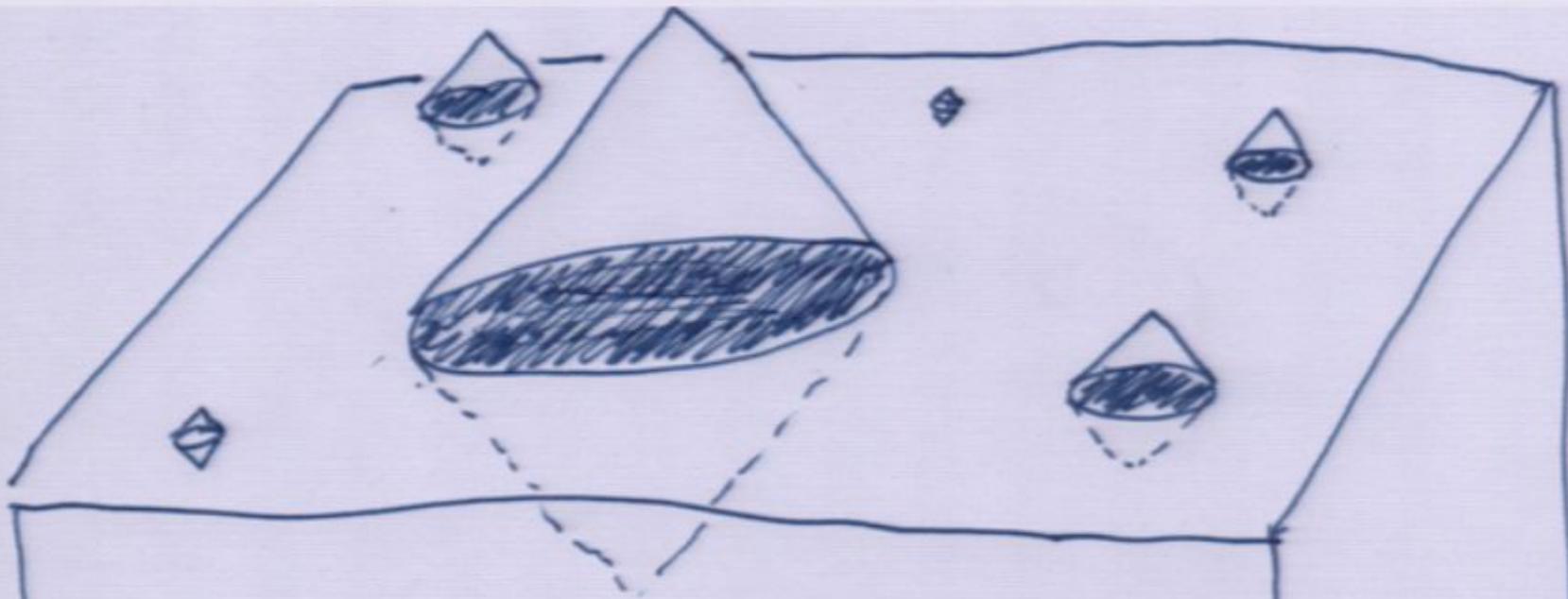
No Eternal Inflation

**1st
order**

**1st
order**

**2nd
order**





A STATISTICAL SYSTEM ON

$$t = \infty$$

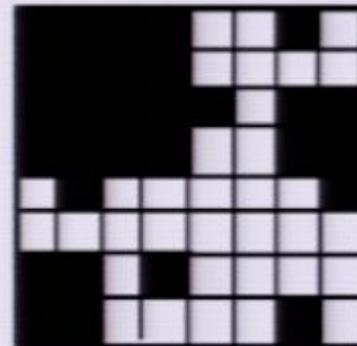
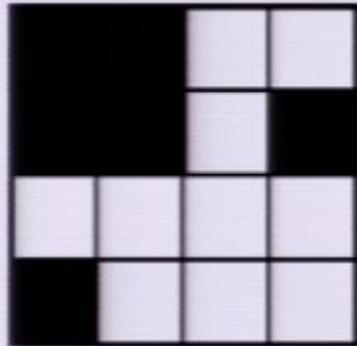
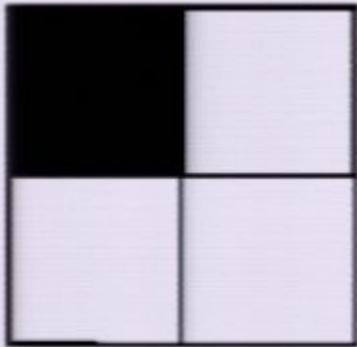
Mandelbrot Percolation Model

Mandelbrot Percolation Model

Chayes, Chayes, Grannan, Swindle

P = "kill" probability
(black)

(3-D version is
obvious
generalization)



Number of "offspring" = 8.

Average number of survivors is $8(1-P)$

Extinction: $8(1-P) < 1$

Transition from Eternal Inflation to No-Eternal-Inflation

V_n = coordinate volume after n steps

$$V_{n+1} = (1-P)V_n$$

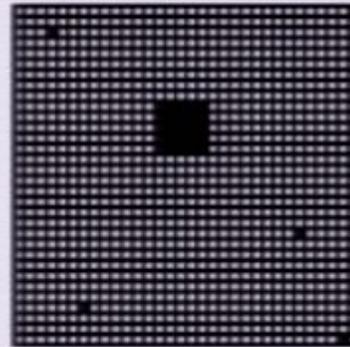
$$V_n = (1-P)^n \rightarrow 0$$

The inflating region becomes a fractal of dimension < 3 .

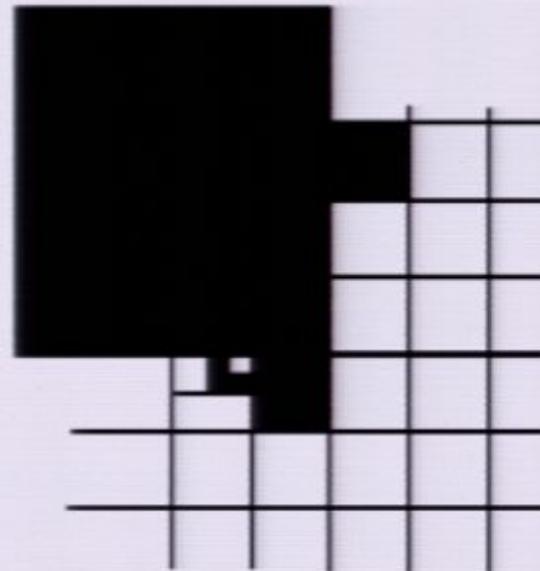
But the number of (white) inflating boxes

$$= \{8(1-P)\}^n \rightarrow \text{infinity if } P > P_{\text{crit}}$$

$P \lll 1$ Black Island Phase



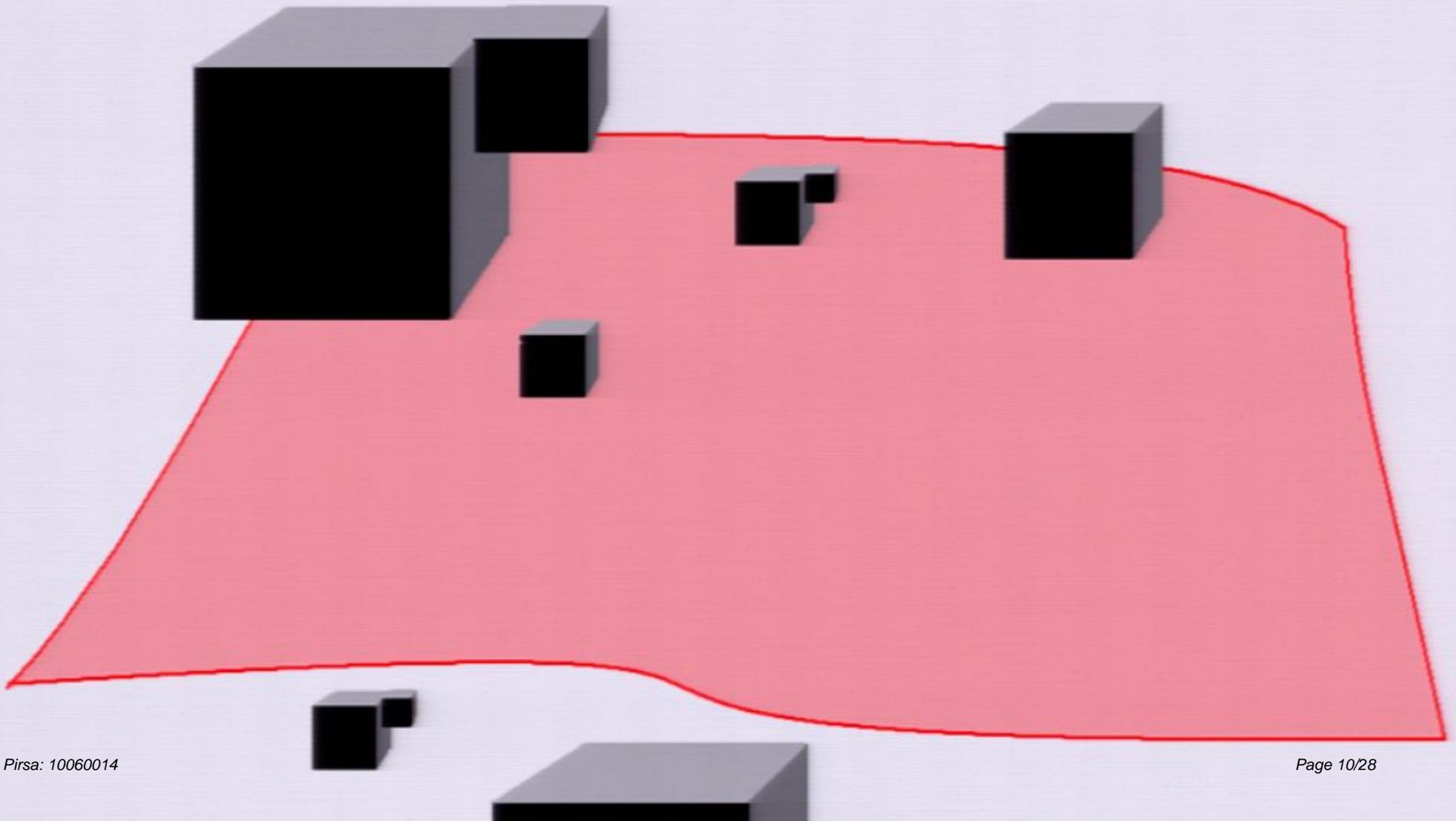
Collisions are inevitable, and so is topology.

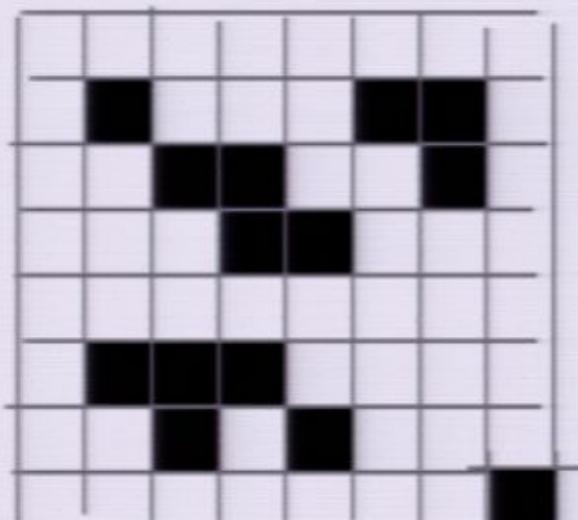
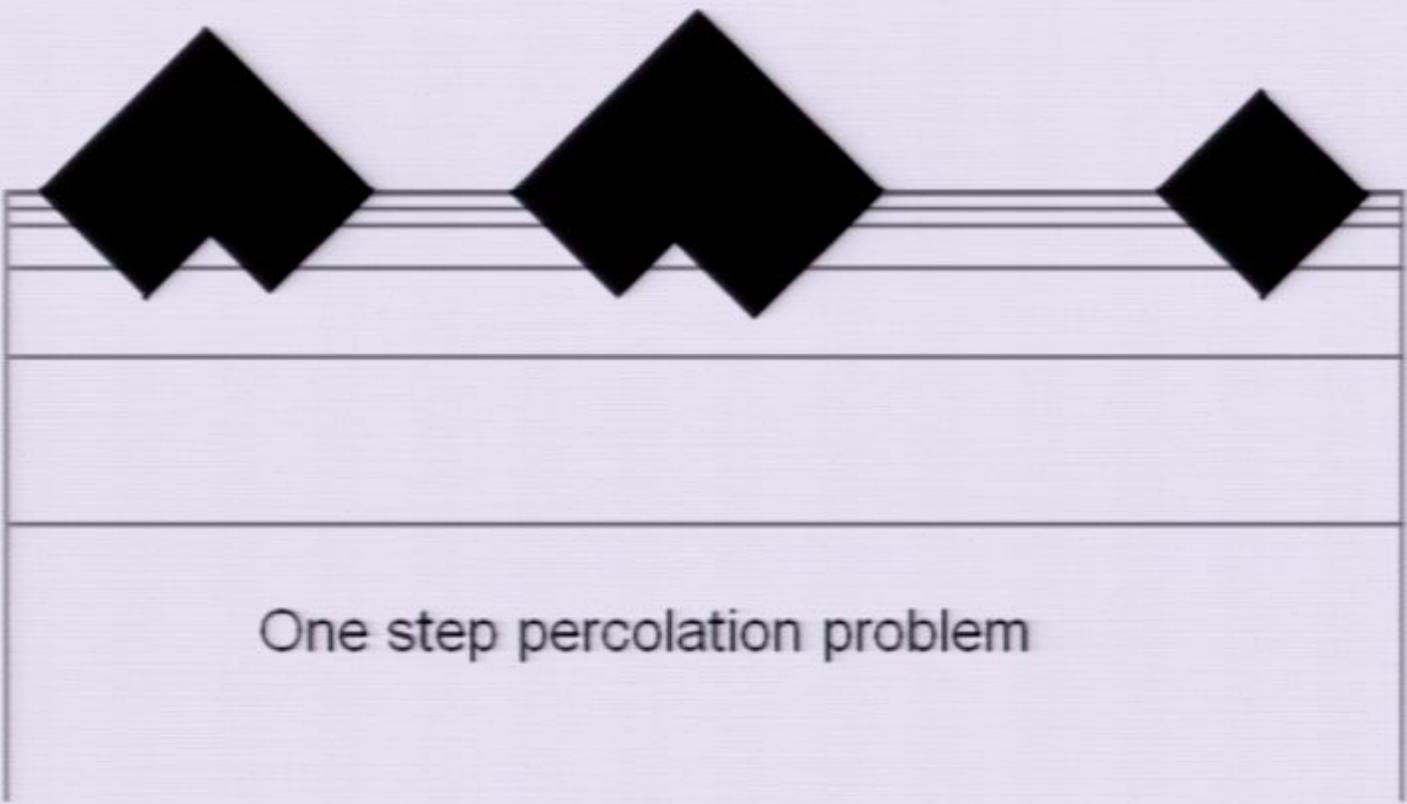


Black Island Phase:

There exist white crossing surfaces for all n .

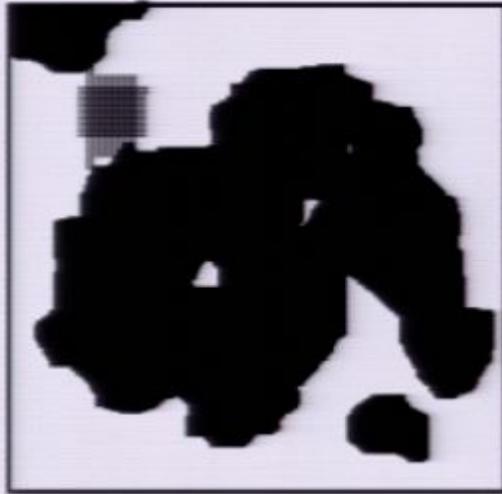
Note that this characterization requires no metric on the future boundary.





Percolation clusters

Ordinary one-step Percolation (3-D)



As P increases the average size of a connected cluster (R) grows.

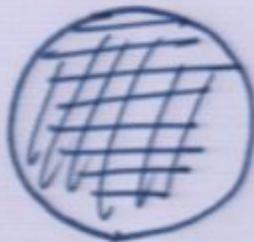
At the 2nd order transition pt, R diverges.
The white crossing surfaces become interrupted.

$WXS \nexists$ but white-crossing-curves do exist.

This is the tubular phase of the percolation problem.

$$\Gamma = \text{RATE}/H$$

$$\Gamma \lll 1$$



BLACK ISLAND

BLACK ISLAND PHASE

$\Gamma \ll 1$



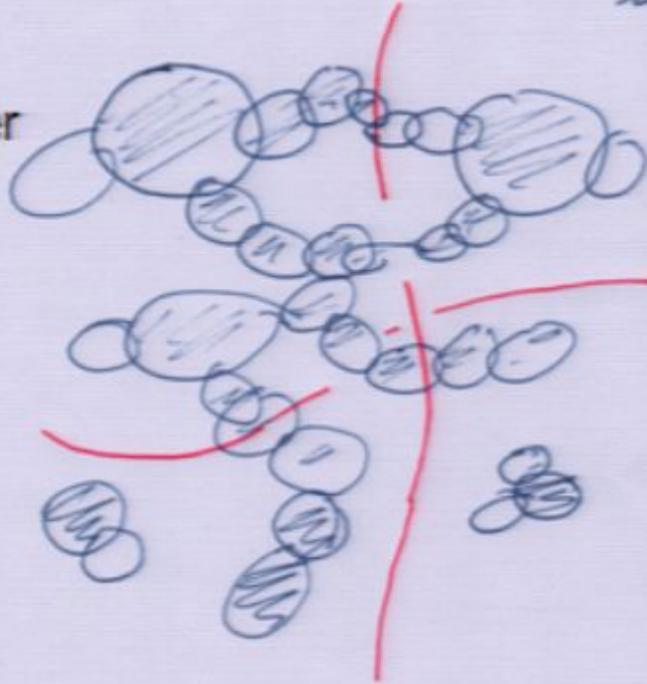
CROSSING
SURFACES

(ALL AT FUTURE)
 ∞

PERCOLATION
 $\beta \sim 1$

BEGIN BY CUTTING
OFF SMALL (LATE)
NUCLEATION

2nd
order



TUBULAR
PHASE

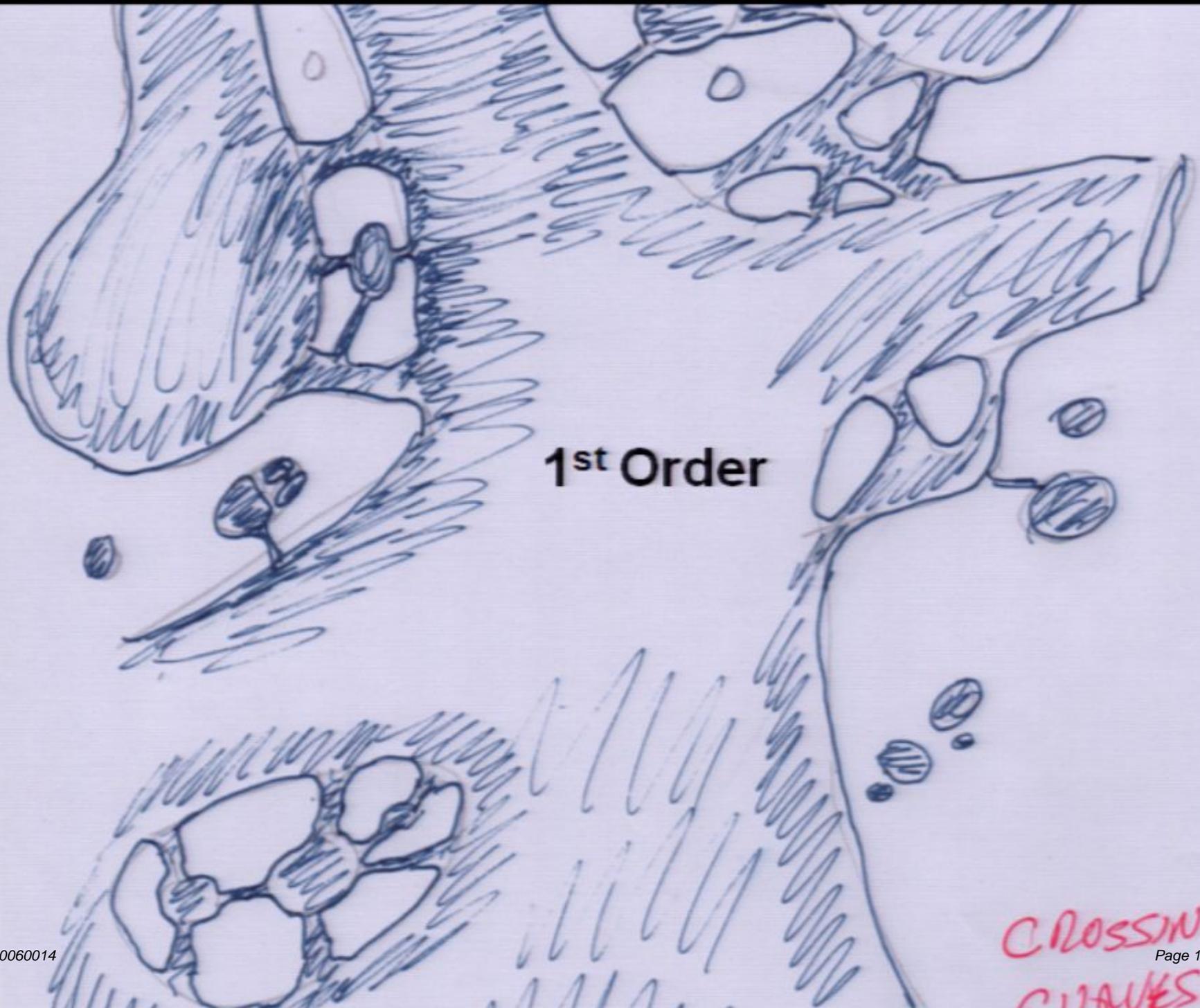
NO CROSSING
SURFACES
BUT CROSSING
CURVES

A SINGLE INFINITE TUBULAR
NETWORK PLUS BLACK ISLANDS



- But in Mandelbrot percolation the tube-like network is the entire black set.





1st Order

CROSSING
CHANGES

Eternal Inflation

No Eternal Inflation

Black Island

Tubular

White Island

No Eternal Inflation

**1st
order**

**1st
order**

**2nd
order**

The final percolation transition is also 1st order. Tubular \rightarrow White Island. In this phase there are no white crossing surfaces or curves. Isolated white (inflating) regions.



Eternal Inflation

No Eternal Inflation

Black Island

Tubular

White Island

No Eternal Inflation

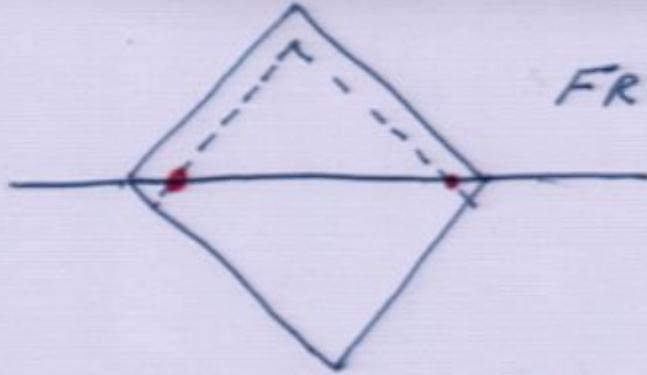
**1st
order**

**1st
order**

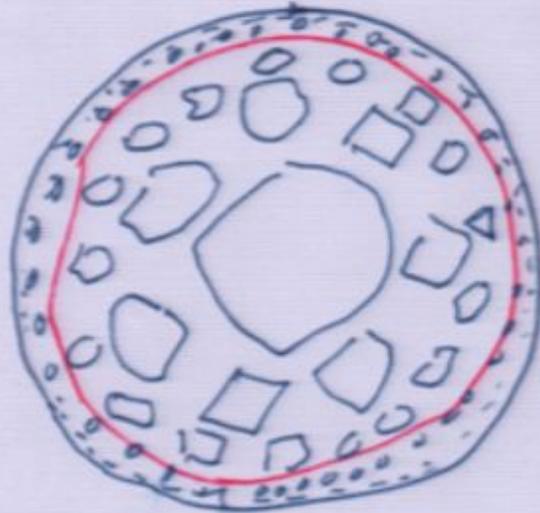
**2nd
order**

The final percolation transition is also 1st order. Tubular \rightarrow White Island. In this phase there are no white crossing surfaces or curves. Isolated white (inflating) regions.





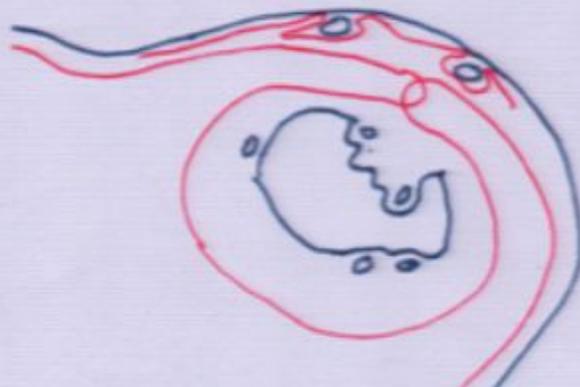
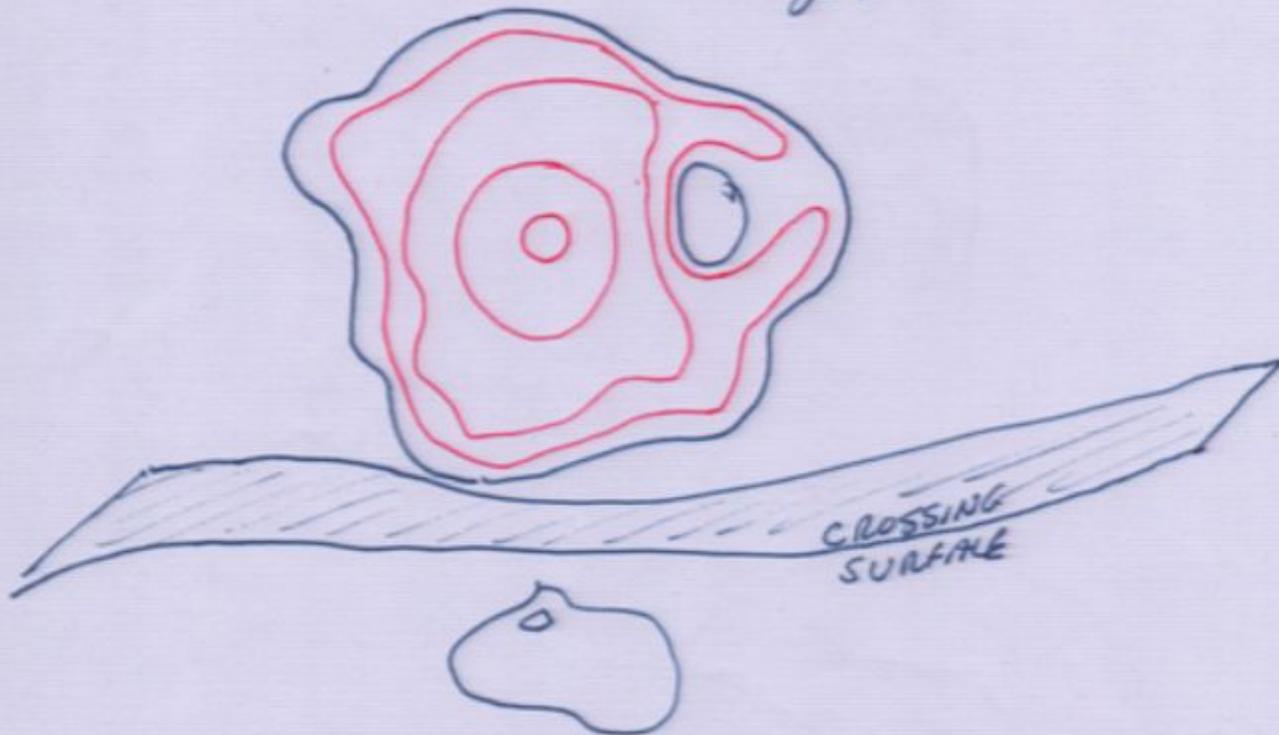
FRW ($k=-1$)



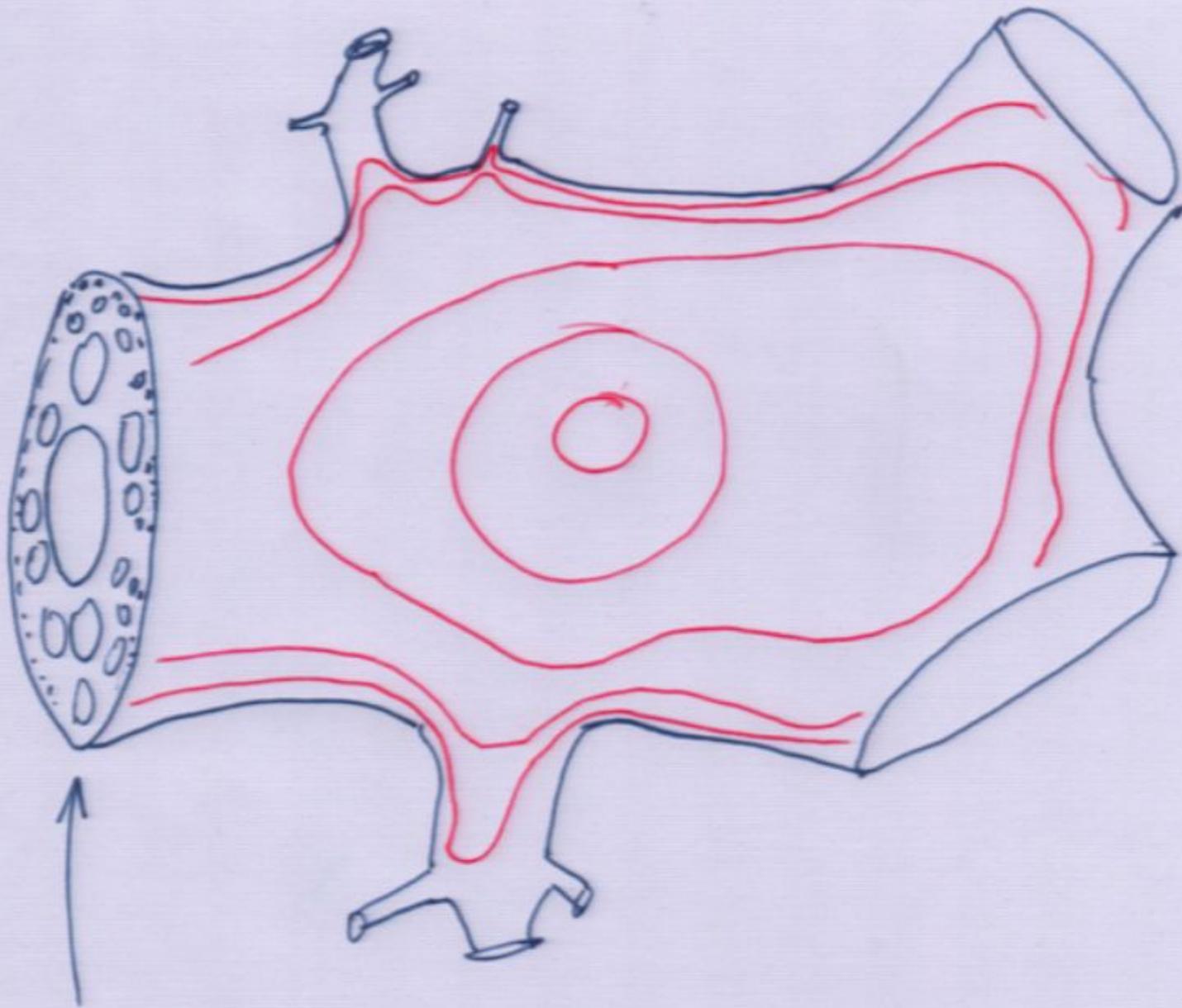
"CENSUS TAKER" SEES SMALLER
AND SMALLER ANGULAR DETAIL.

FRW/CFT RG FLOW

Everything in a black island is
visible (eventually)

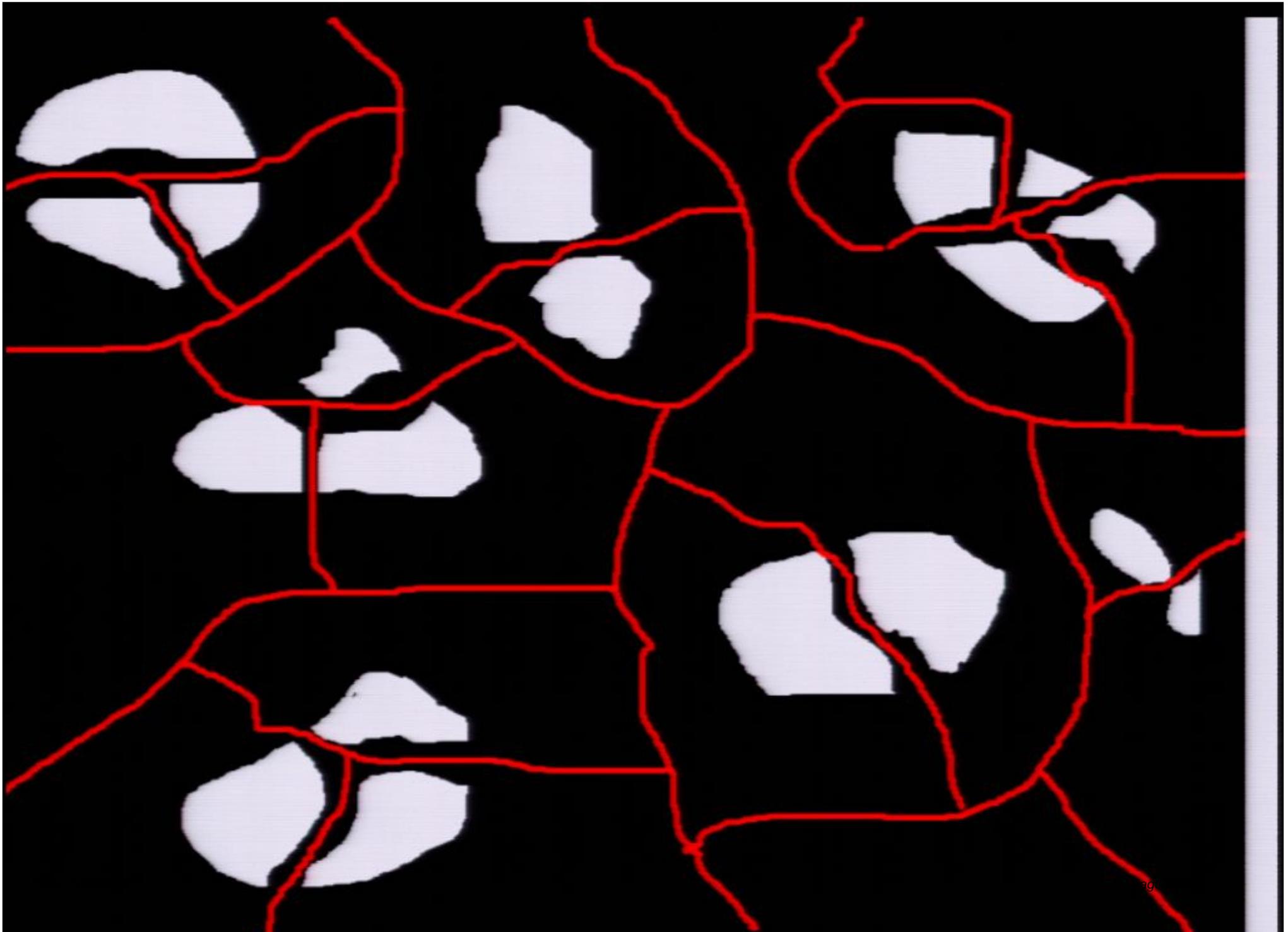


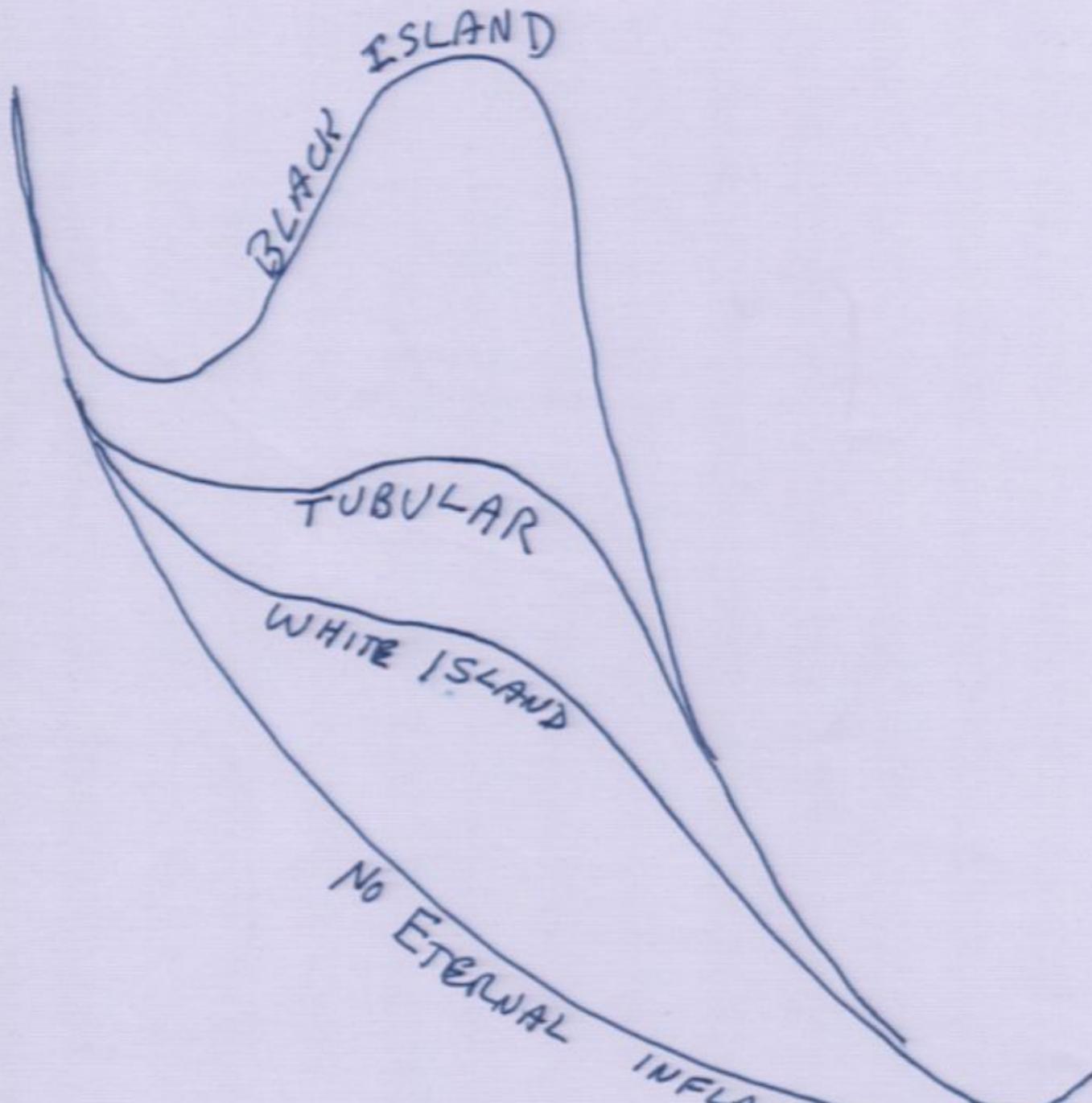
DIFFERENT
ISLANDS
ARE NOT
VISIBLE



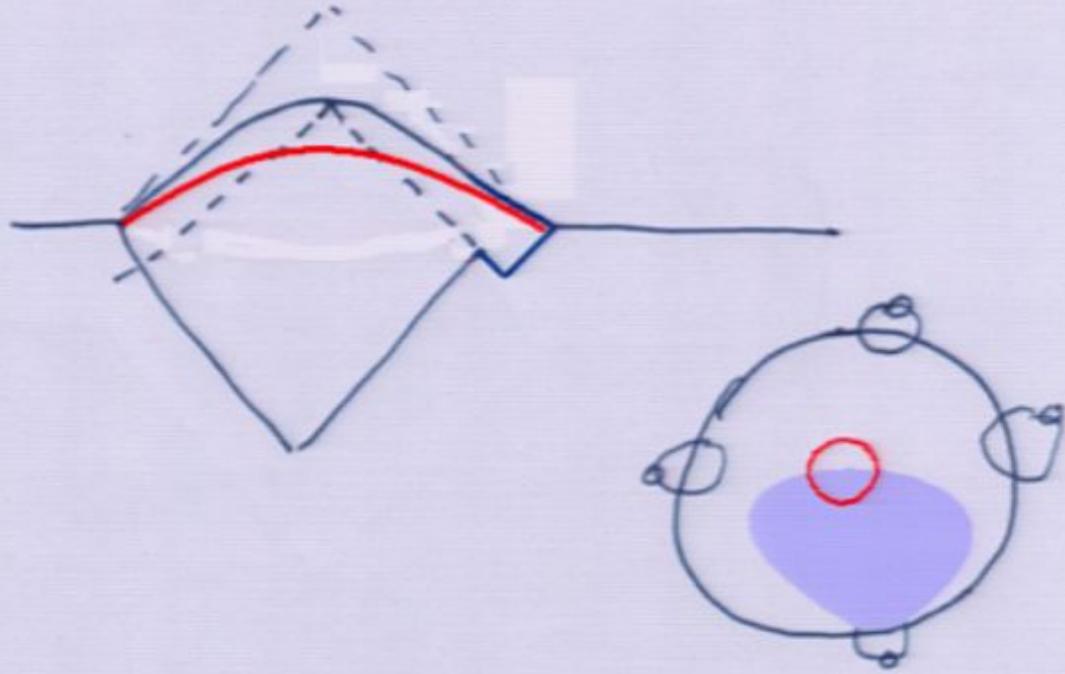
Pomeare
"DISK"







EVER SER?



Maybe $l=2$