Title: Phases of eternal inflation
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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

\[ V \]

rate varies.

No eternal inflation

Eternal Inflation

White

Black

\( \phi \)
Mandelbrot Percolation Model

Chayes, Chayes, Grannen, Swindle

\[ P = "\text{kill}" \text{ probability} \]
\[ \text{(black)} \]

(3-D version is obvious generalization)

Number of "offspring" = 8.

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

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

This is the 2\text{nd} order transition from NEI to EI.
Transition from Eternal Inflation to No-Eternal-Inflation

\[ V_n = \text{coordinate volume after } n \text{ steps} \]

\[ V_{n+1} = (1-P)V_n \]

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

The inflating region becomes a fractal of dimension \(< 3\).

But the number of (white) inflating boxes

\[ = \{8(1-P)\}^n \rightarrow \text{infinity if } P > P_{\text{crit}} \]
$P \ll 1$  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.
One step percolation problem

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 $\not\exists$ but white-crossing-curves do exist.

This is the tubular phase of the percolation problem.
\[ \Gamma' = \text{RATE/H} \]

\[ \Gamma' \ll 1 \]

BLACK ISLAND
Black Island Phase

$\Gamma \ll 1$

(Crossing Surfaces)

(All at Future $\infty$)
2nd order

Percolation

Begin by cutting off small (late) nucleation

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.
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 1\textsuperscript{st} order. Tubular $\rightarrow$ White Island. In this phase there are no white crossing surfaces or curves. Isolated white (inflating) regions.
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.
"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