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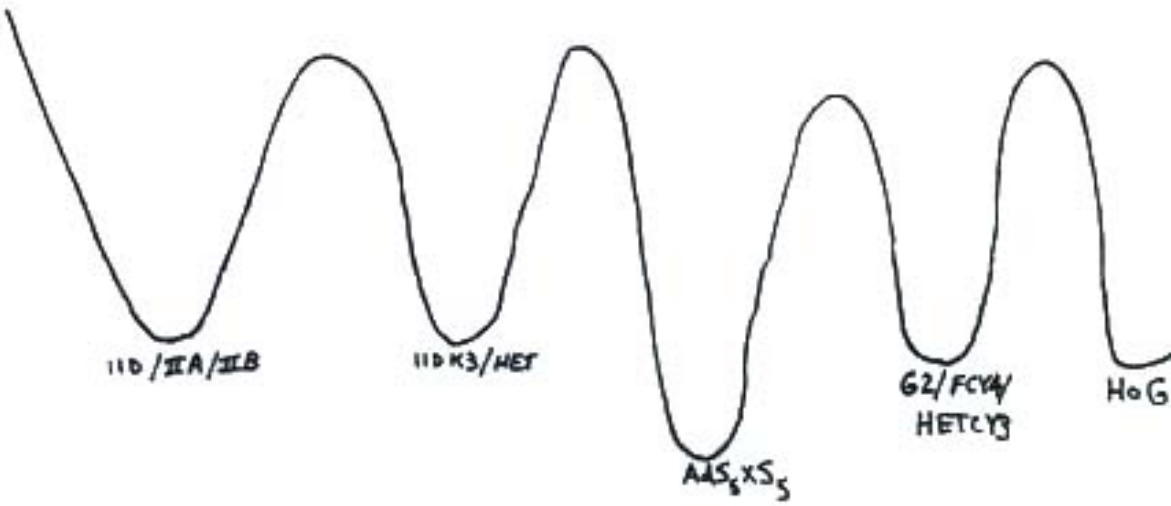
A Critique of Pure String Theory

M-theory: A Set of Moduli Spaces of (Mostly) SUSic
Poincare or AdS Invariant Theories of QG
SUSY + Gravity $\Rightarrow$ (BPS) Strings

Our Conventional Wisdom: All Vacua of One Hamiltonian



I Will Challenge This View

The Definition of A Quantum Theory

Feynman: $e^{-iHt} \sim e^{-iH_0 t} e^{-iVt} \quad t \to 0$

Short Time (High E) Pert of Gaussian Model

$\to$ Classical Mech. and Canonical Quant.

More Generally, Wilson: HE Behavior Non Gaussian CFT

General FT: CFT + Relevant Ops.

Green's Fcns. Det by First Few Terms of OPE

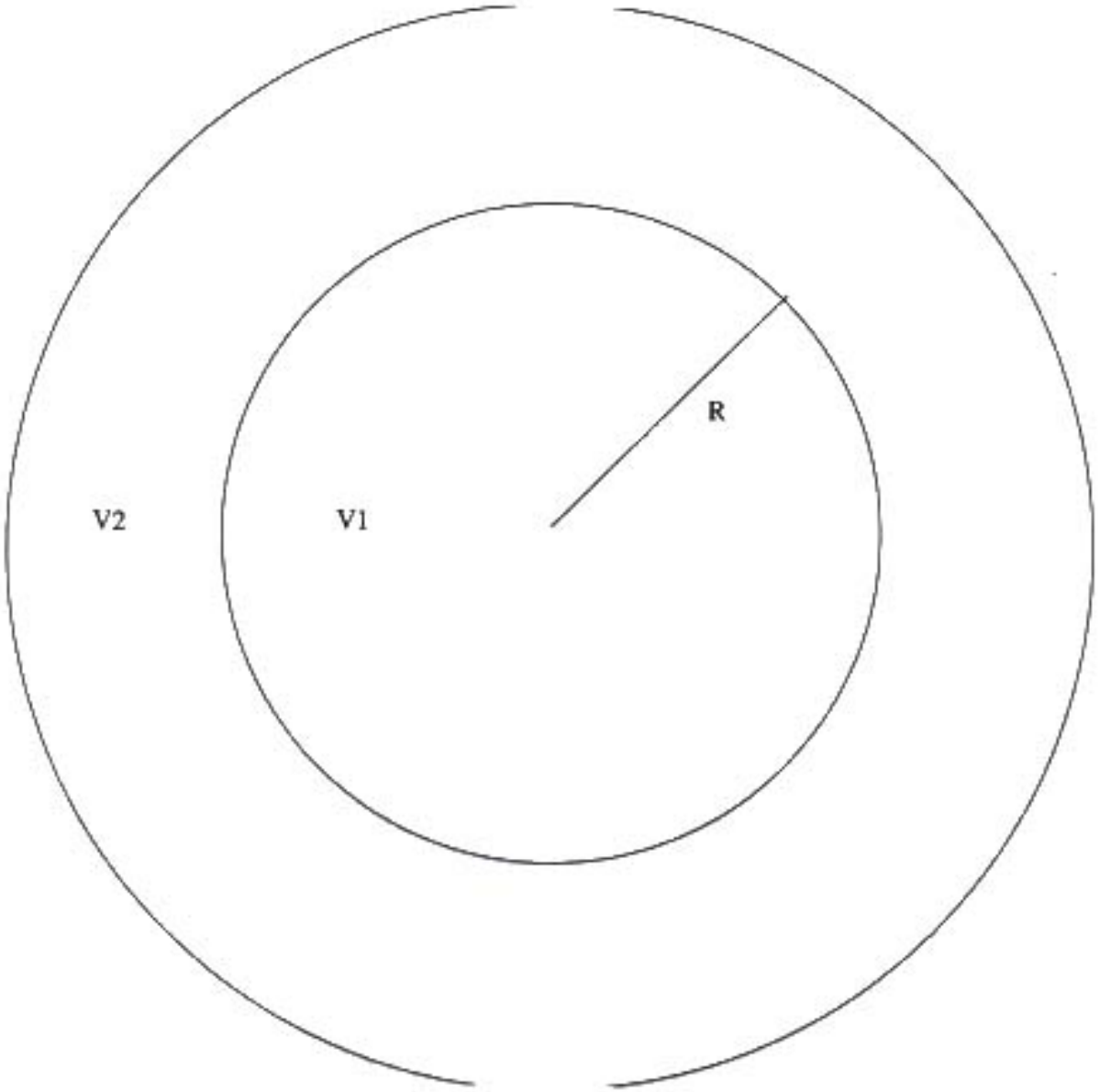
$O_I(x)O_J(0) \sim \sum x^{-(d_I+d_J-d_K)} C_{IJK} O_K$

Different Vacua of Given Hamiltonian:

(IR) Different Reps. of Same (UV) Op. Alg.

Depends on UV/IR *Separation* (RG) of Local FT

An Alternative Way of Finding One Vac. in Another



Make Bubbles of V_1 in V_2

The High energy Behavior of Quantum Gravity

TB/Aharony/hep-th/9812237; TB/Fischler/9906038; TB Davidfest

Based on Older Work in GR and String Theory

HE Dominated By Black Holes: IR Sensitive

The Ultimate UV/IR Connection

As A Consequence, The Choice of Vacuum and Hamiltonian

Are Harder to Disentangle

cf Def. of H by Surface Integral at ∞ in GR

Scattering at Large Mandelstam Invariants Produces Black Holes

Amplitudes are IR Sensitive, "Vacuum "Dependent

Example: "Derivation "of AdS/CFT

General Principles + Asymptotic Darkness $\Rightarrow$

QM of AdS_d is Conformally Inv. on $R \times S^{(d-2)}$

And Has HE Spectrum of CFT_{d-1}

Energy Not Extensive in $d-1$ Space Dimensions

In AF Spacetime Asymptotic Darkness

$$\rho(E) \sim e^{E^{\frac{(d-2)}{(d-3)}}}$$

The Trouble With Bubbles

TB hep-th/0011255

Bubble of Radius R_{max}, Tension σ

Has $M_{bubble} \geq \sigma R^{(d-2)} = R_S^{(d-3)}$

So $R_S \sim R^{\frac{(d-2)}{(d-3)}} > R$ For Large R

So Attempt to Make A Big Bubble Forms A Black Hole Instead

Decay to Old Vacuum, No Trace of Inside

On a Moduli Space We *Can* Interpolate With Bubbles

But to Make Bubble of Size R of V_1 in V_2

Need Sequence of $d(V_1, V_2)$ Bubbles, With

Largest of Size $C^{d(V_1,V_2)}R$, $C > 1$.

$\Rightarrow < 0|O(t_1)\ldots O(t_n)|0 >$ Are Not Distributions

On Space of Functions W/ Compact Support

M^d, $d > 4$ Light Cone QM in Better Shape

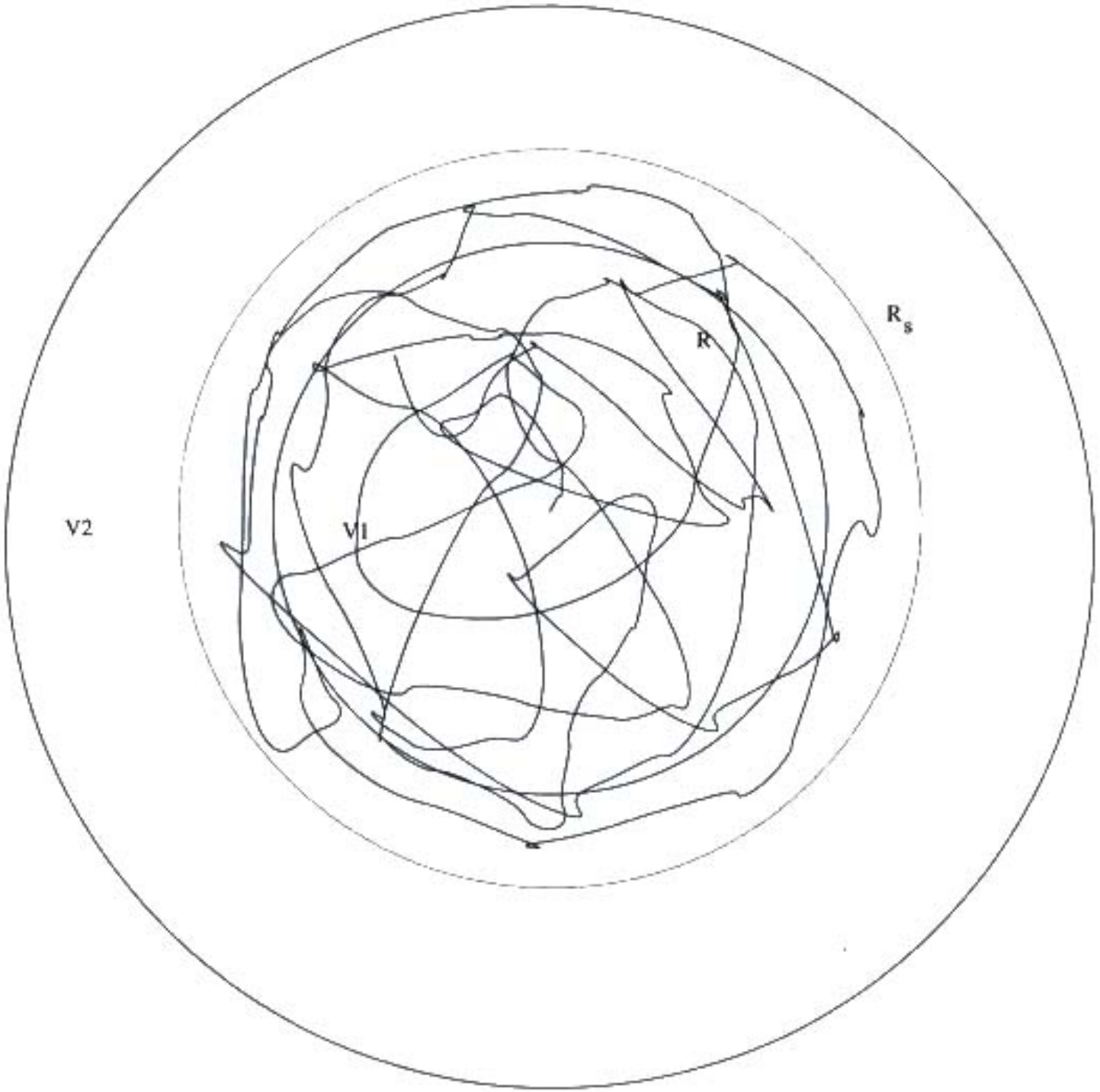
$P^- = M^2/P^+$

M^4 Hagedorn in Light Cone

Connected(?) With IR Divergences, Nonexistence of

S-Matrix, BMS Group and All That

Note: Even in LCFT, Change of Vac. Is Change of Hamiltonian


R_s
R
V2
V1

BPS Domain Walls

Can Interpolate Between Two "AdS "Vacua, But

1. Often Perturbation by Relevant Op., Not Change of Vac.

New State Has Fewer UV DOF: C Theorem

2.Really Brane Phenomenon, Not AdS - On $R \times S^d$

RG Flow to IR Stops at (BIG) AdS Scale

AdS_3 Has A Sort of Induced Vacuum Decay For

Special Values of Parameters in Space of Hamiltonians

Emission of Long Strings

Conclusion: Many AdS Hamiltonians for QG

Negative Λ is Discrete Tunable Parameter

Which Controls High Energy Density of States

Don't Believe Naive Extrapolation to GR of

Classical Lagrangian Picture of Vacua

So Where Does This Leave String Theory?

At Least A Finite Number of Exactly SUSic Hamiltonians

With Asymp. M or AdS Space of Various Dimensions
Probably Also Stable Non SUSic AdS Vacua (GKP,ES)

Resolve by Claiming Real World is dS
Positive Λ is Discrete Tunable Parameter
UV = IR Cutoff, $N_{states} = e^{\frac{3\pi}{\Lambda}}$

$May \Rightarrow \Lambda \to 0$ Limit : Isolated $\mathcal{N} = 1$,
$d = 4$ SUSic Hamiltonian of String Theory
Caveats: Maloney, Silverstein, Strominger; Fre, Trigante, van Proeyen

So the Problem is Still, Find $W = D_i W = 0$

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