

Title: The Problems with Dynamical Quantum Spacetime.

Date: Aug 11, 2009 04:00 PM

URL: <http://pirsa.org/09080061>

Abstract: A discussion of the properties of the dynamics of spacetime and how certain aspects of the relational dynamics lead to difficulties in the quantum theory.

1. Classical Phys

2. GR

3. QM

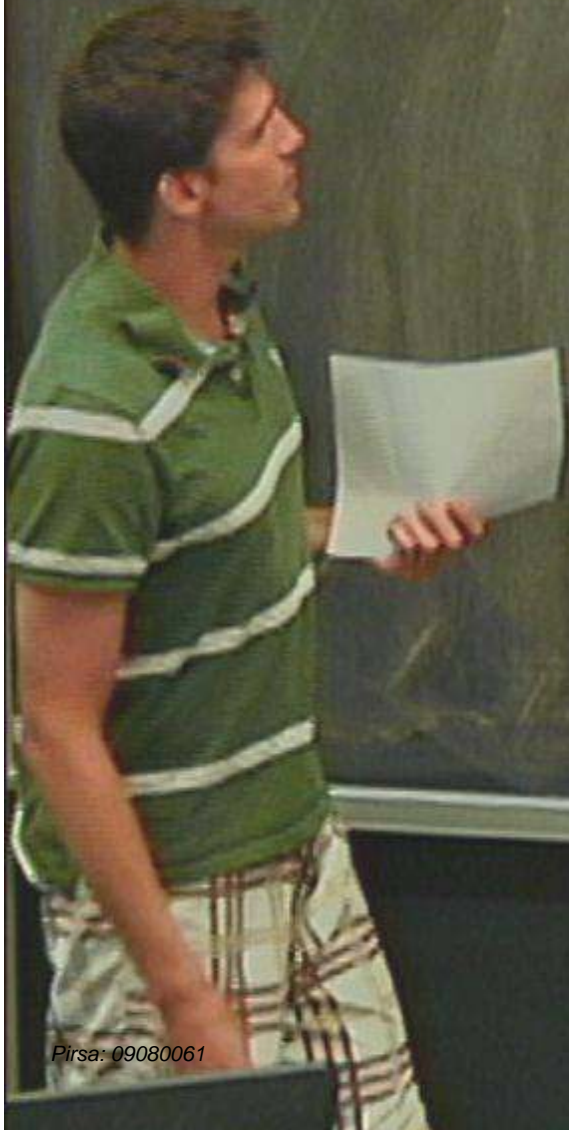
4. Prob

Q What is classical phys?



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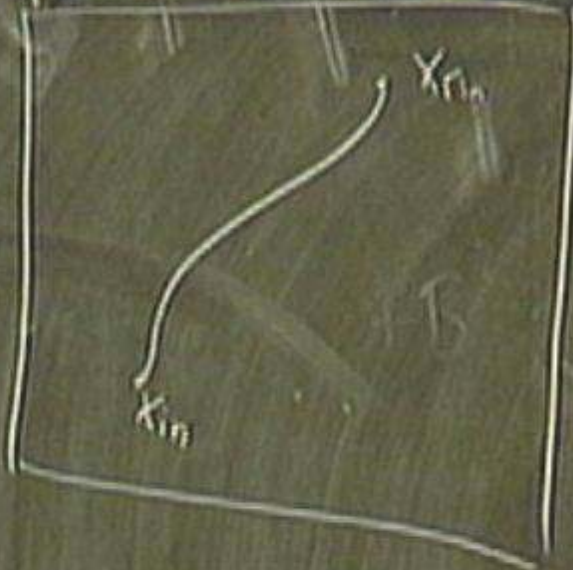
SOAP notes



Q What is classical phys?

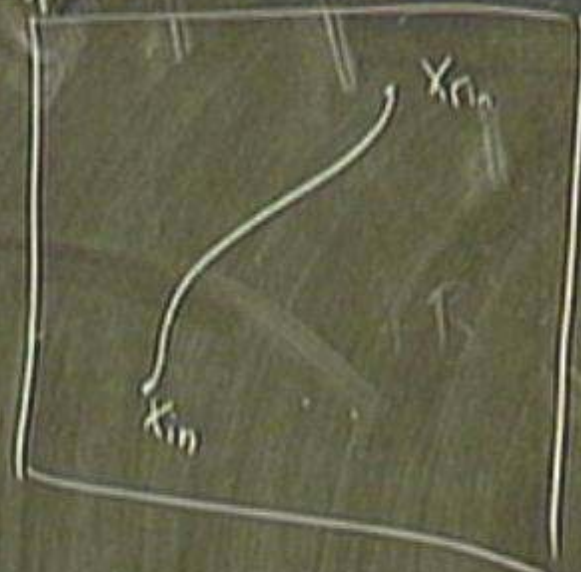


SOAP NEWS



Q What is classical phys?

SOAP nows



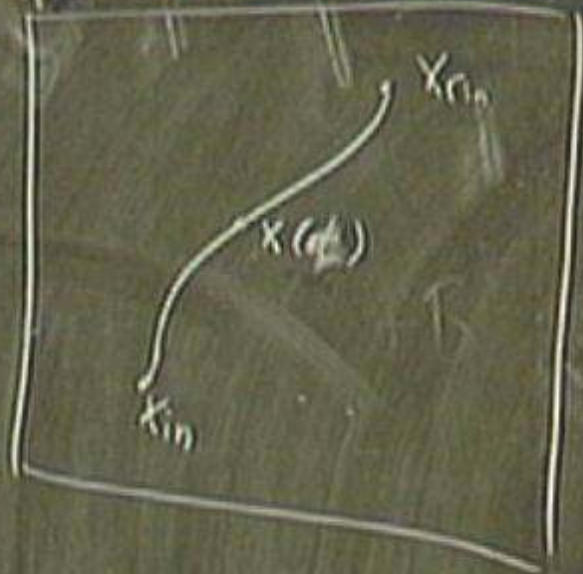
Q

clock

Q What is classical phys?



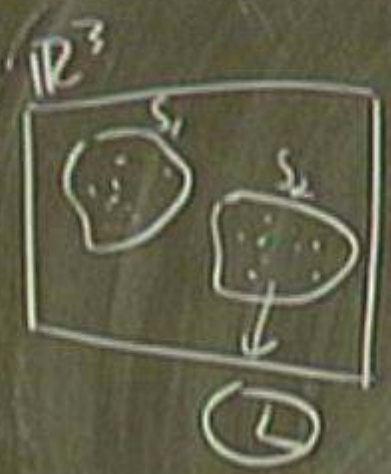
S.O.D.P. now

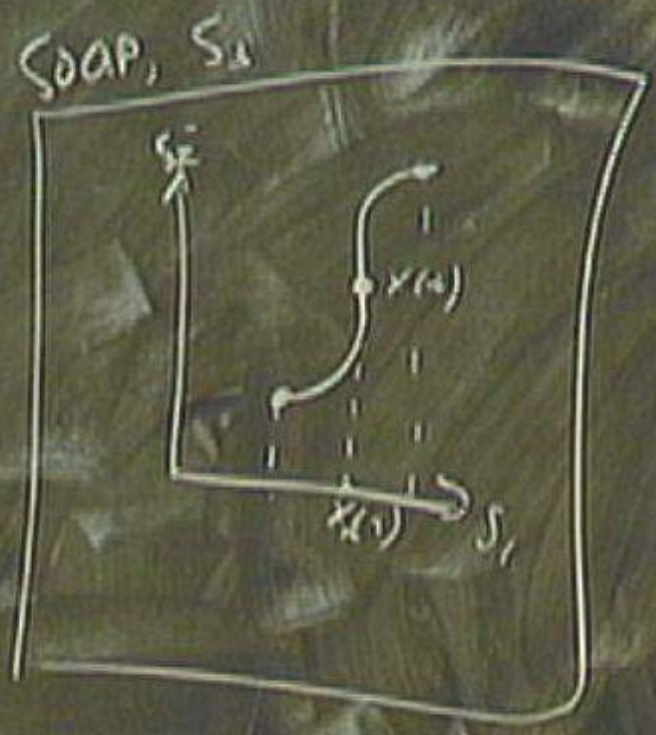
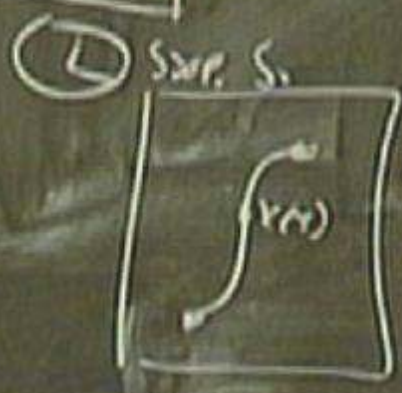
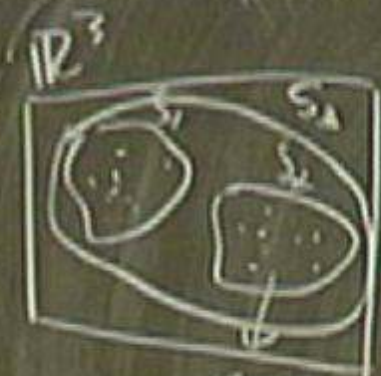


Q

clock

eg length, Sun path

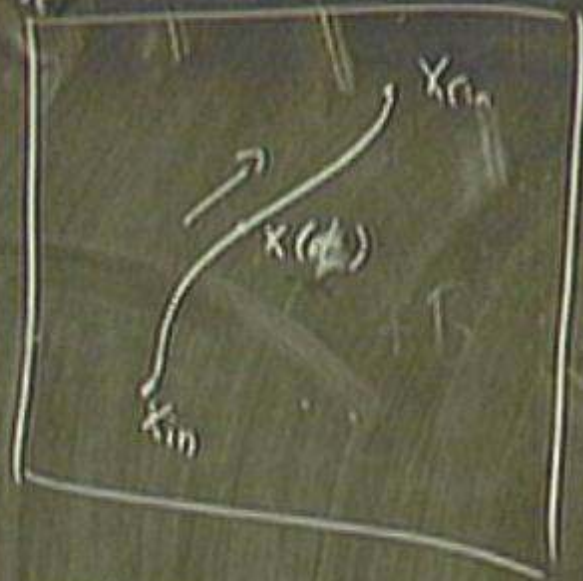




Q What is classical Recitly plays?



SOAP rows



Q

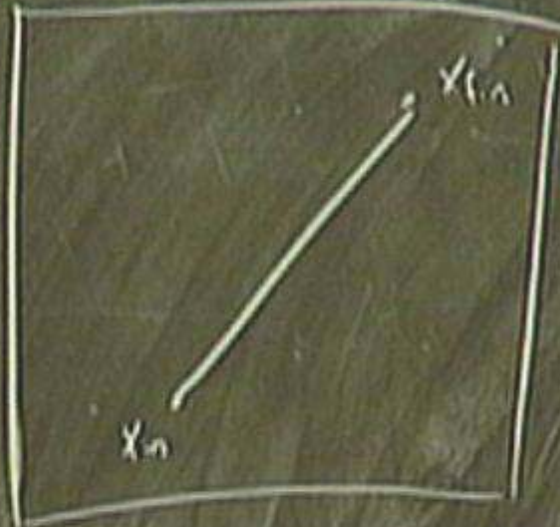
clock

eg. length, sum, path

$$t_n = \text{length}$$

Q. What is physics?

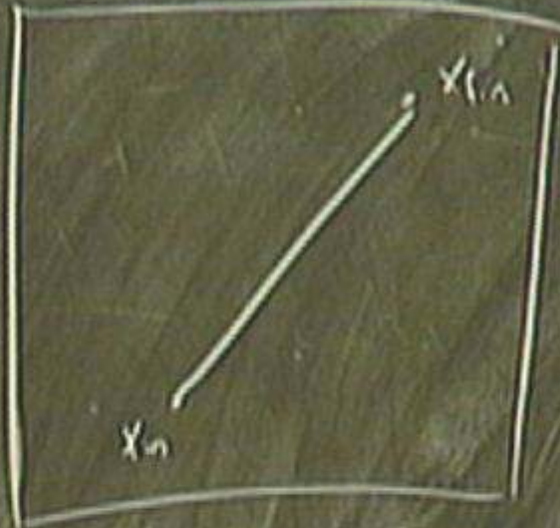
سوال نمبر



Q. What is physics?

ساده است

A. $x_{in} \rightarrow x_{fin}$
↓
Shortest distance



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ساده است

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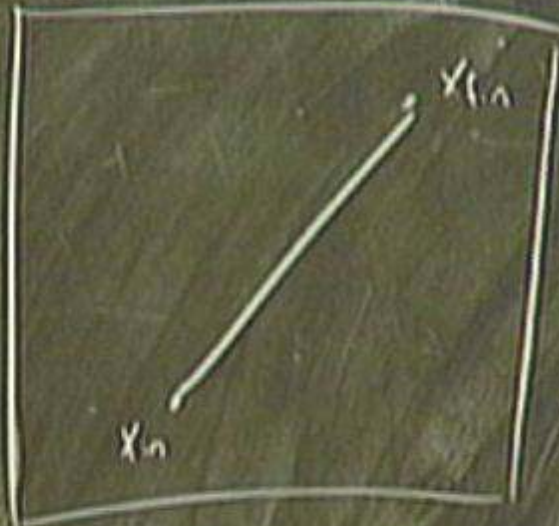


Q. What are forces?

Q. What is physics?

سوالات

A. $x_{in} \rightarrow x_{fin}$
↓
Shortest distance



Q. What are forces?

→ Curvature of CS

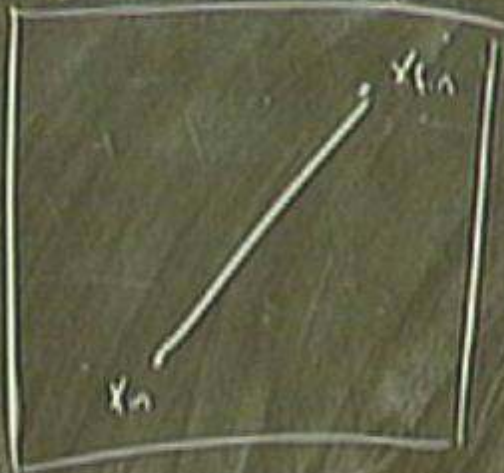
Q. What is physics?

A. $x_{in} \rightarrow x_{fin}$
↓
Shortest distance

Q. What are forces?

→ Curvature of CS

SOOP NEW



Q. What is a symmetry?



Q: What is a symmetry?



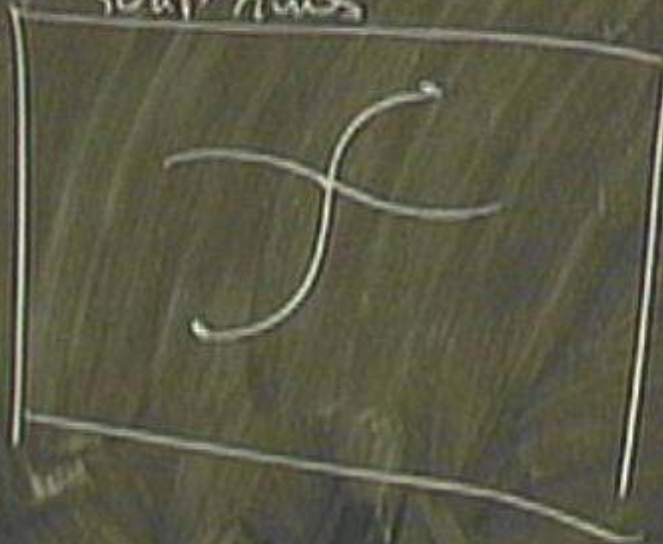
A: Coordinates are redundant.

Q. What is a symmetry?

\mathbb{R}

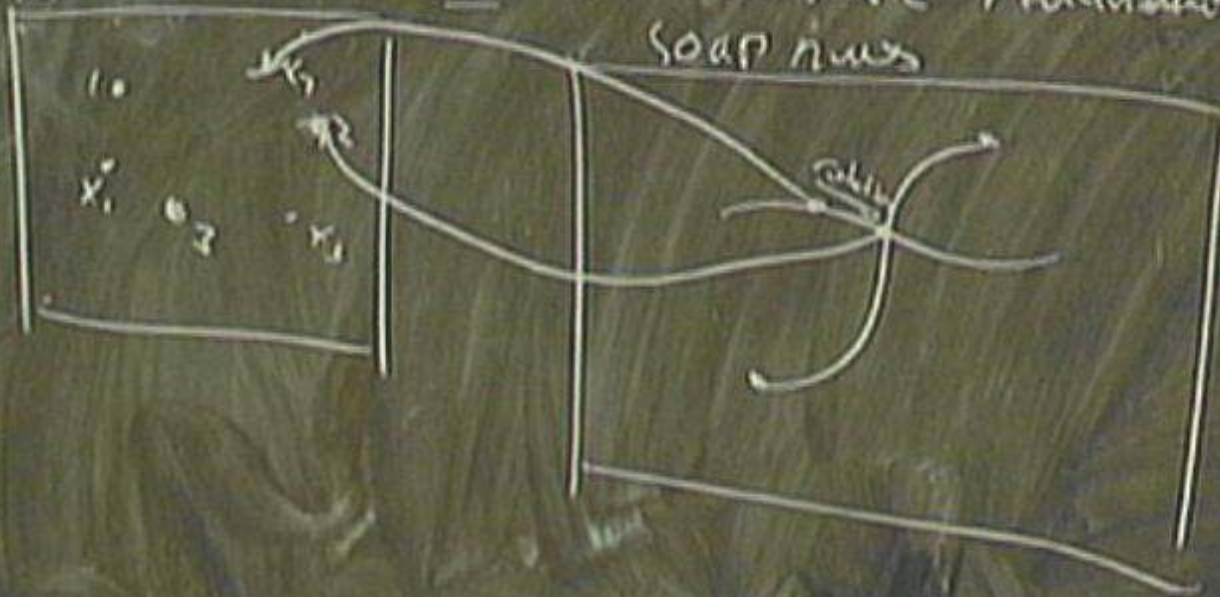


A Coordinates are redundant.
Soap films



Q. What is a symmetry?

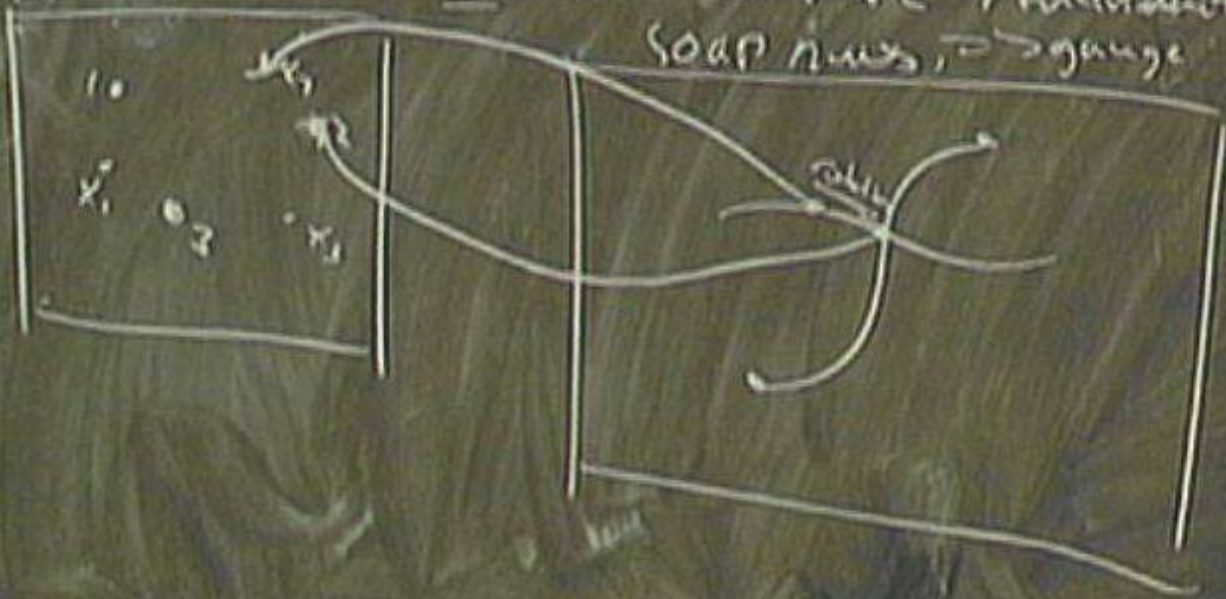
\mathbb{R}



A coordinates are redundant.
SOAP rules

Q. What is a symmetry?

\mathbb{R}



A. Coordinates are redundant.
SOAP nuts, \rightarrow gauge

1. Classical Phys

2. GR

3

4.



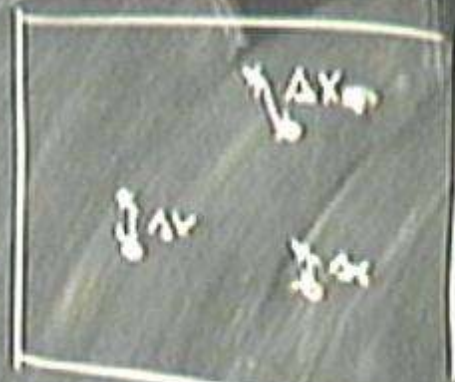
$$\min(\mathcal{L}) = \left(\sum (\Delta x_i)^2 \right)^{1/2}$$

1. Classical Phys

2. GR

3. QM

4. Prob



But not taking
~ gauge thing

$$\min(T) \propto \left(\sum (\Delta x_i)^2 \right)^{1/2}$$

2. GR:

Newton \Rightarrow X_i

Einstein \Rightarrow g (metric)

1. Topology can't change by stretching



Newton $\Rightarrow X_i$

Einstein $\Rightarrow g$ (metric)

Topology can't change by stretching



2. GR:

Newton \Rightarrow X_i

Einstein \Rightarrow g (metric)

Topology

can't change by stretching



2 GR

Newton \Rightarrow χ_i

Einstein \Rightarrow g (metric)

1. Topology

can't change by stretching



top prop holes, handle, knots, braids, ...

handle

2 Curvature:



$$\sum \alpha_i = \pi$$

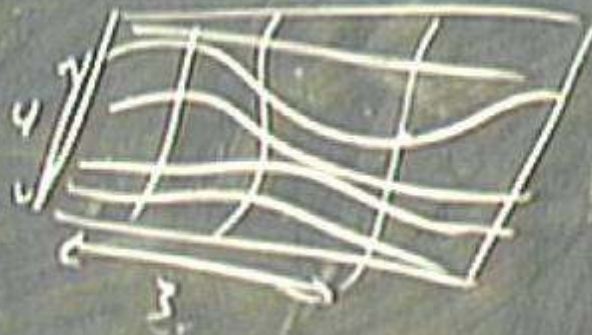
$$\sum \alpha_i \rightarrow \pi \quad K < 0$$



3 Coordinates (net, cc)



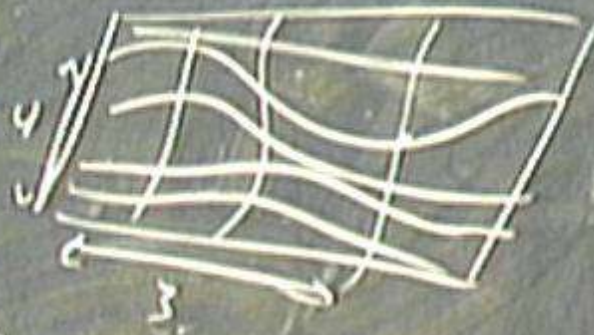
3 Coordinates (Metric)



3 coordinates (net, cc), g

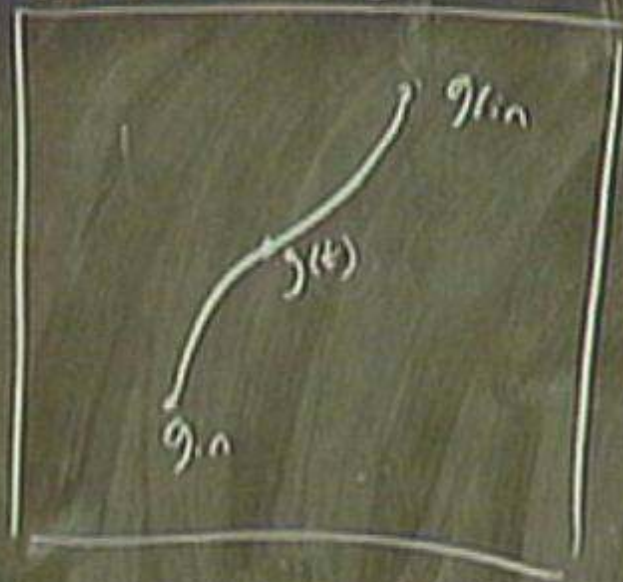


\neq

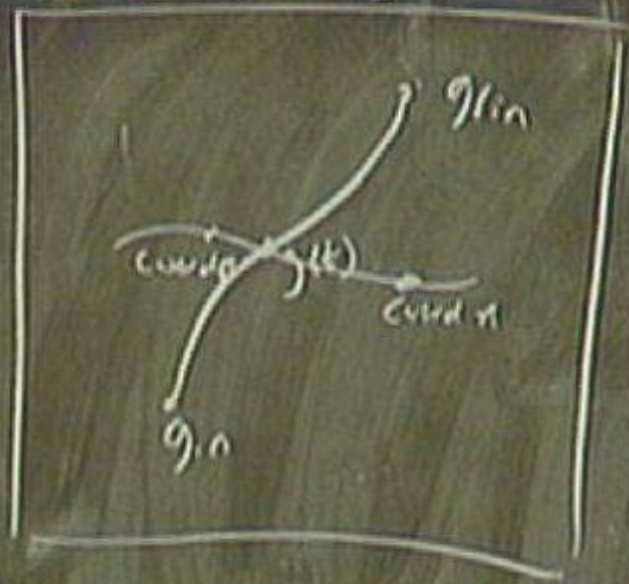


E. Phys should not depend on coords
If it depend on coordinates

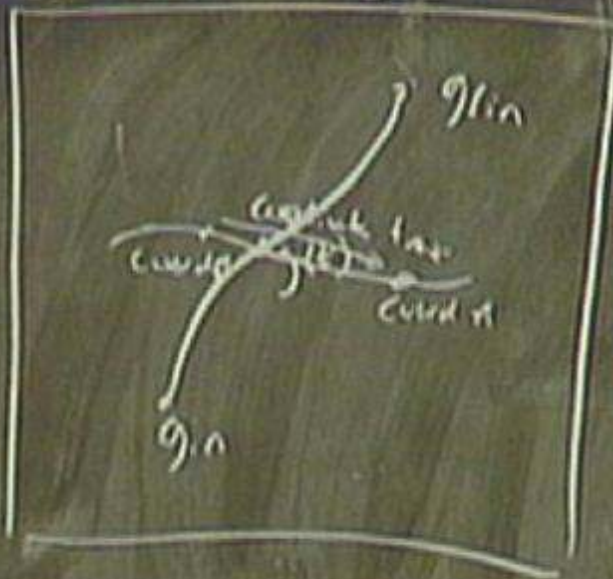
GP SOAP Metric 5



GP SOAP Metric 5



GP Soap Metric 5



Best matching

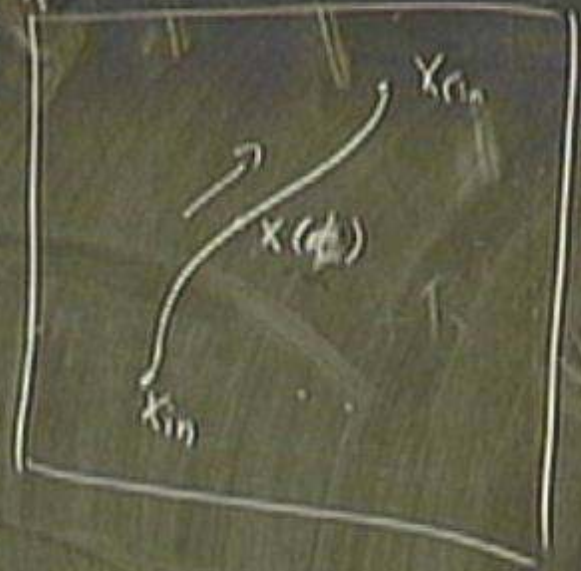
$$\text{"Force"} \rightarrow (R - 2\Lambda)$$

↓
curved line cost

$$t \sim \frac{\text{length}}{(R - 2\Lambda)}$$

Q What is quantum reality physics?

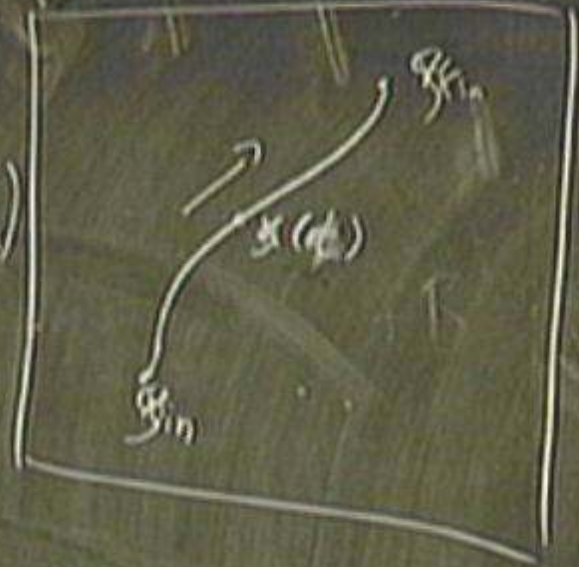
SOAP notes



Q What is quantum reality physics?

$$|\langle g_{out} | g_{in} \rangle|^2 = \text{prob}(g_{out} | g_{in})$$

SOAP news

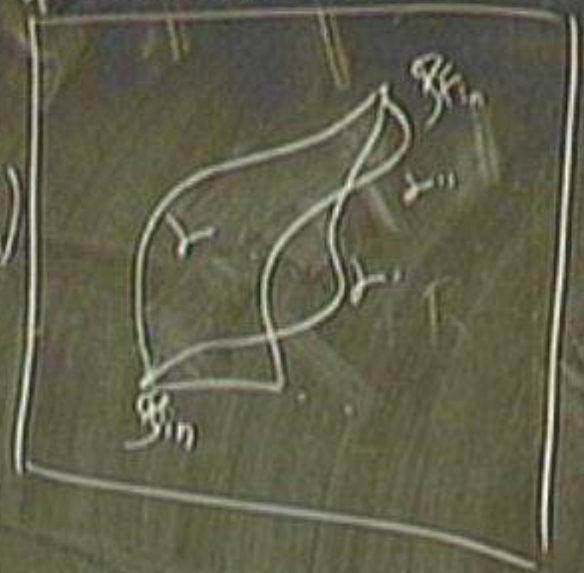


Q What is quantum reality physics?

SOAP NOUS

$$|\langle g_{out} | g_{in} \rangle|^2 = \text{Prob}(g_{out} | g_{in})$$

$$\sum_{\text{all } \gamma} e^{i\text{length}(\gamma)}$$



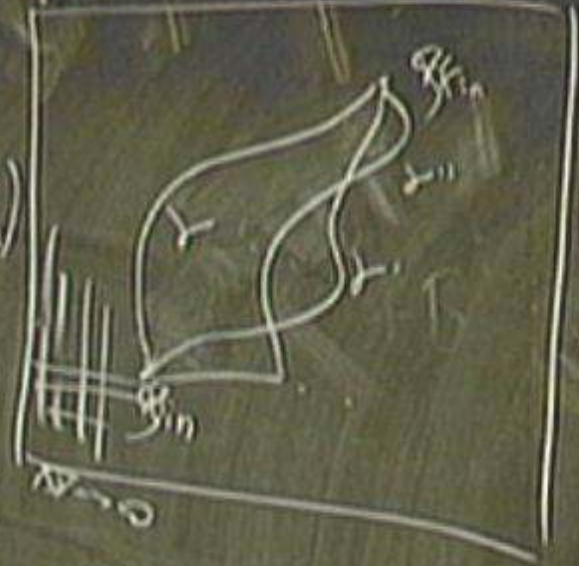
Q What is quantum reality physics?

SOAP notes

$$\langle \psi | \psi \rangle = \text{Prob}(g_{in} | g_{in})$$

$$\sum_{\text{all } \gamma} e^{i \text{length}(\gamma)}$$

1. If I start in g_{in} the Prob = Prob being in g_{in} after a round!



Q What is quantum reality physics?

SOAP NOUS

$$\langle g_{out} | g_{in} \rangle = \text{Prob}(g_{out} | g_{in})$$

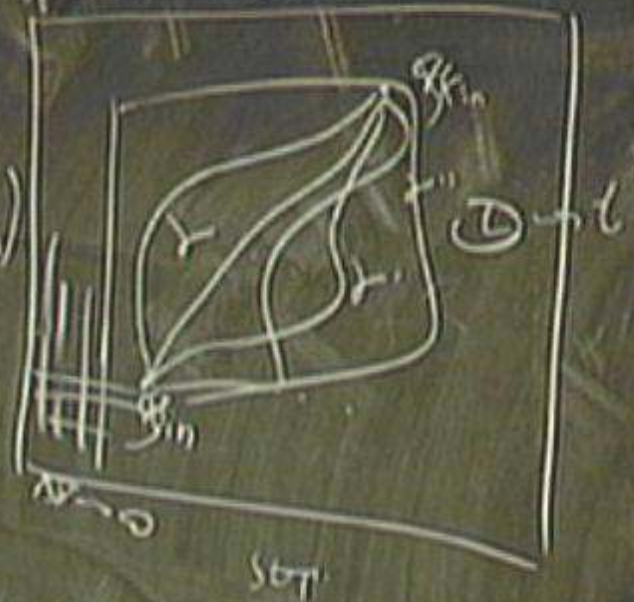
1. $\sum_{\text{all } \gamma} e^{i \text{length}(\gamma)}$

2 If I start in g_{in} the

1 Problem of Time

2 Measurement problem

Prob = Prob being in g_{in} after a measurement

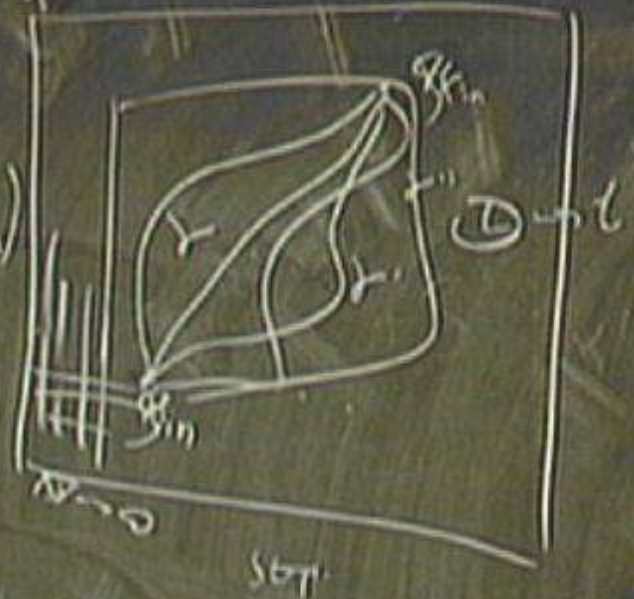


Q What is quantum reality physics?

SOAP NOUS

$$\langle g_{out} | g_{in} \rangle = \text{Prob}(g_{out} | g_{in})$$

$$\sum_{\text{all } \gamma} e^{i \text{length}(\gamma)}$$



2 If I start in g_{in} the

Prob = Prob finding in g_{out} after a measurement

1 Problem of Time

2. Measurement problem.