

Title: Asymptotic fragility, superluminality and pi

Date: Apr 10, 2015 09:45 AM

URL: <http://pirsa.org/15040105>

Abstract:

Asymptotic Fragility, Superluminality and  $\pi$   $c > 0$

w Moller, Cooper  
Flanagan, Bombardieri

$\pi = 3,141592$

$$\mathcal{L} = \frac{1}{2} (\partial X)^2 + \frac{c}{\Lambda^4} (\partial X)^4 + \sum_{i=1}^{D-2} X^i$$

$$S = -\rho_S^{-2} \int d^D \sigma \sqrt{-\det(\gamma_{\alpha\beta} - \partial_\alpha X^\mu \partial_\beta X^\mu)}$$

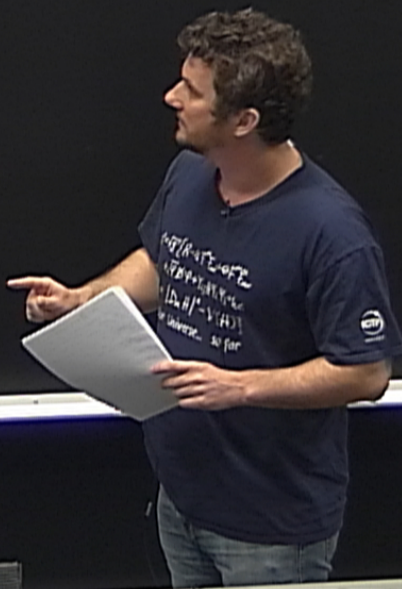
and  $\pi$   $\frac{c > 0}{\Lambda^4}$

$$k^2 + \frac{c}{\Lambda^4} (\partial X)^4 + \dots$$

,  $z=1, \dots, D-2 > 0$

$$\int d^D \sigma \sqrt{-\det(\gamma_{\alpha\beta} - \partial_\alpha X^i \partial_\beta X^i)}$$

- 1) 2d UV completion?
- 2)  $D=3,4$
- 3) UV, 2d:





and  $\pi$   $\frac{c > 0}{\Lambda^4}$

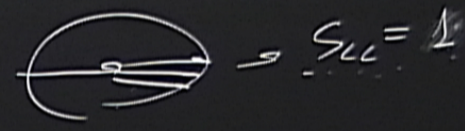
$$r + \frac{c}{\Lambda^4} (\partial x)^4 +$$

$r = 1, \dots, D-2 > 0$

$$\frac{d^2 \sigma}{ds^2} - \det(\gamma_{\mu\nu} - 2\alpha' X^\mu \partial_\mu X^\nu)$$

x

- 1) 2d UV completion?
- 2)  $D=3,4$
- 3) UV, (2.1):



a) Integrable, reflectionless

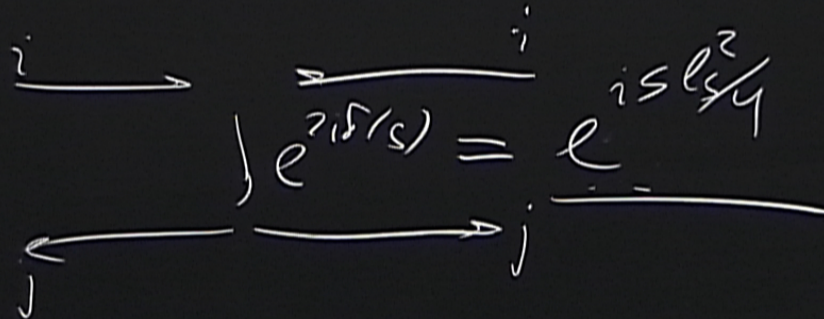
$$\left. \begin{array}{c} \longrightarrow \\ \longleftarrow \end{array} \right\} e^{2\phi(s)} = e^{2\phi_0 + \frac{r^2}{4}s} \longrightarrow$$

1) 2d UV completion?

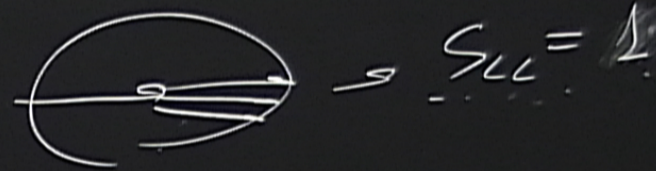
2)  $D=3,4$

3) UV, (2.1):

A) Integrable, reflectionless



The diagram shows a scattering process. On the left, an incoming particle labeled 'i' moves to the right. On the right, an outgoing particle labeled 'i' moves to the right. Below these, an incoming particle labeled 'j' moves to the left, and an outgoing particle labeled 'j' moves to the left. In the center, there is a region representing an interaction, with the expression  $e^{2i\delta(s)} = e^{i s l^2 / 4}$  written there.

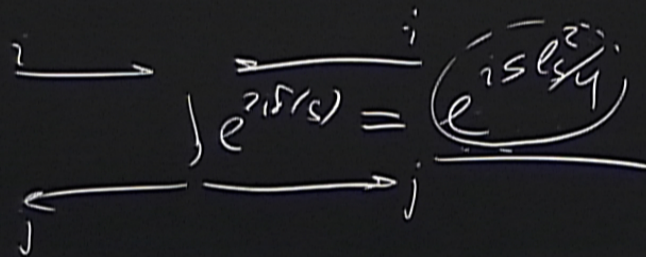


1) 2d UV completion?

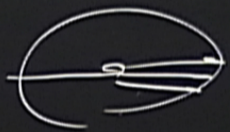
2)  $D=3,4$

3) UV, (2.1):

A) Integrable, reflectionless



$$e^{i\delta(s)} = e^{i\pi/4}$$



$$\rightarrow S_{LL} = 1$$

$$\frac{1 - \cos \theta}{D=3,26}$$

$$\frac{D-26}{192\pi} (\partial_a \partial_{x^i})^2 (\partial_b \partial_{x^j})^2$$

CAUTION

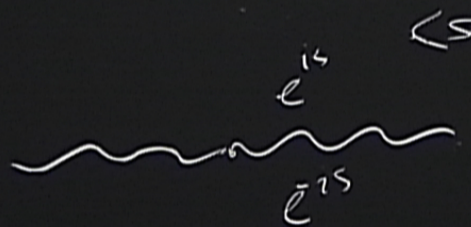
CAUTION

4) TBA

$$E = \sqrt{\frac{4\pi^2(N-\tilde{N})^2}{R^2} + \frac{R^2}{l_s^4} + \frac{4\pi}{l_s^2} \left( N + \tilde{N} - \frac{D-2}{12} \right)}$$

$$\frac{s^3 + t^3 + u^3}{4} = 0$$

$$\left( \frac{\partial x^i}{\partial \tau} \right)^2 + \left( \frac{\partial x^j}{\partial \sigma} \right)^2$$

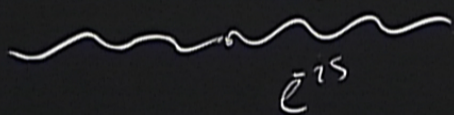




4) TBA

$$E = \sqrt{\frac{4\pi^2 (N - \tilde{N})^2}{R^2} + \frac{R^2}{l_s^4} + \frac{4\pi}{l_s^2} \left( N + \tilde{N} - \frac{D-2}{12} \right)}$$

$e^{15} \leftarrow S$



$\bar{e}^{15}$

1) no UV CFT

$$2) \delta t_{\text{cl}} = \frac{1}{2} E l_s^2 \left( \delta t_{\text{cl}} \right)$$

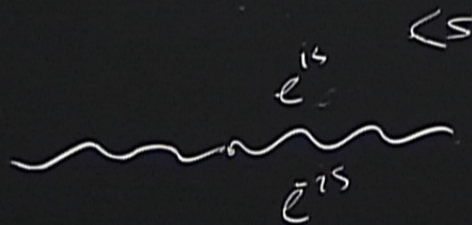
26)  $\frac{S^2 + T^2 + U^2}{4} = 0$

$$\left( \partial_\alpha \partial_\beta X^i \right)^2 \left( \partial_\gamma \partial_\delta X^j \right)^2$$

CAUTION  
DO NOT TOUCH THE BOARD OR THE CHALK  
IF NECESSARY USE THE ERASER OR THE CHALK  
DO NOT REMOVE THE BOARD

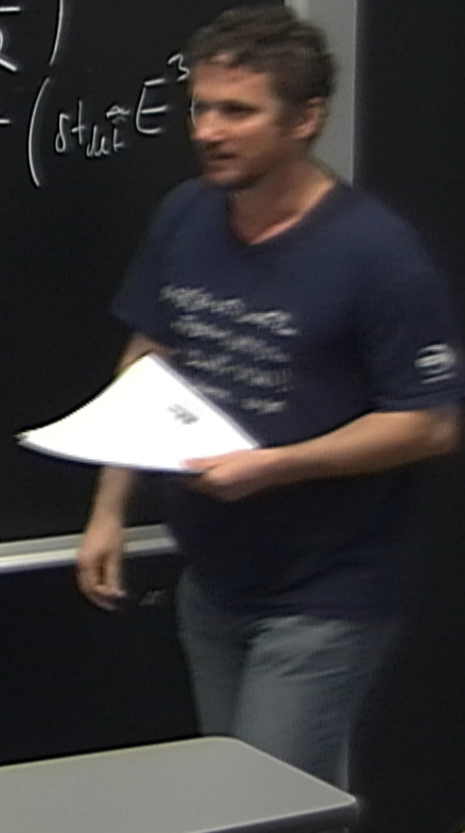
4) TBA

$$E = \sqrt{\frac{4\pi^2(N-\tilde{N})^2}{R^2} + \frac{R^2}{l_s^4} + \frac{4\pi}{l_s^2} \left( N + \tilde{N} - \frac{D-2}{12} \right)}$$



1) no UV CFT

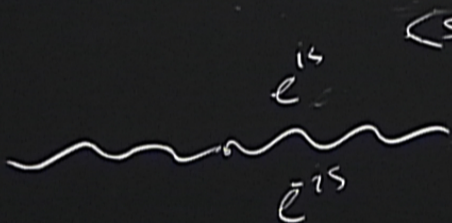
$$2) \delta t_{\text{ret}} = \frac{1}{2} E l_s^2 \left( \delta t_{\text{ret}} E^3 \right)$$



4) TBA

$$E = \sqrt{\frac{4\pi^2(N-\tilde{N})^2}{R^2} + \frac{R^2}{l_s^4} + \frac{4\pi}{l_s^2} \left( N + \tilde{N} - \frac{D-2}{12} \right)}$$

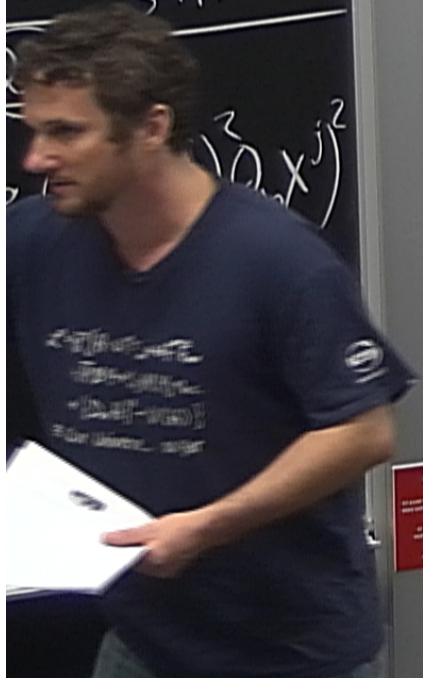
2)  $\delta t_{\text{ret}} = \frac{1}{2} E l_s^2 \left( \delta t_{\text{ret}} \approx E^3 l_s^4 \right)$



1) no UV CFT



$S = -1 + u^3 = 0$   
 $(\partial_\mu X^j)^2$



CAUTION  
 Do not touch the chalkboard when the board is in use.  
 Do not touch the chalkboard when the board is in use.  
 Do not touch the chalkboard when the board is in use.

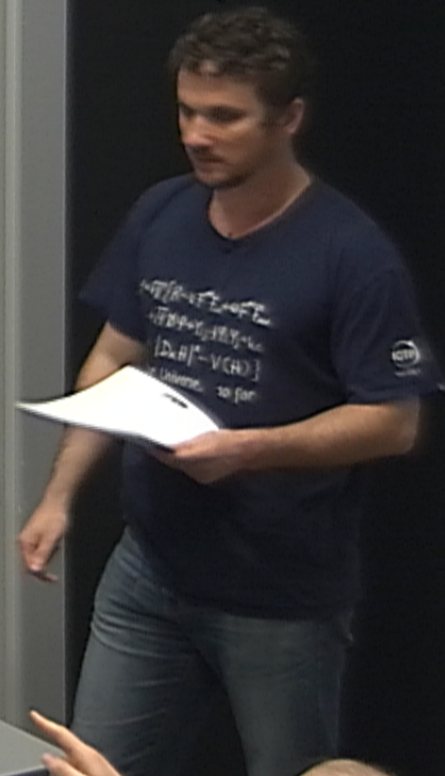
3)  $\underline{T_{41}}$

4)  $R_{min}$

5)



$$\underline{\Delta X_{out}^2 = \Delta X_{in}^2 + \frac{l_s^4}{\Delta X_{in}^2}}$$

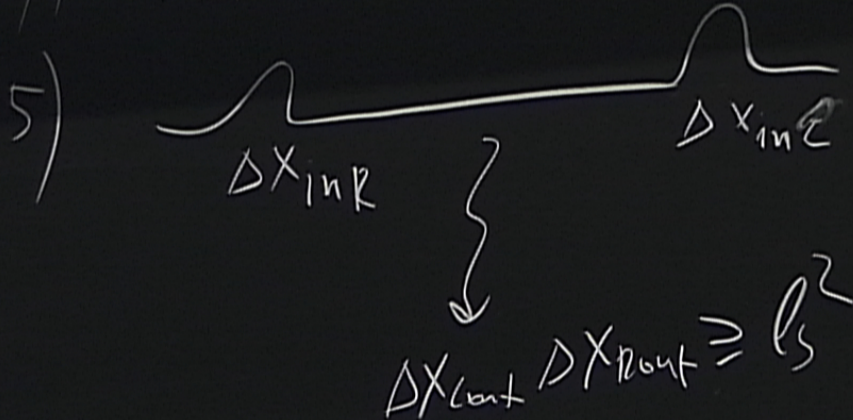


CAUTION  
Do not touch the board with bare hands.  
Use the eraser to clean the board.  
Do not use the board for other purposes.  
© 2011 Blackboard Inc.

1) no UV CFI



5) f min

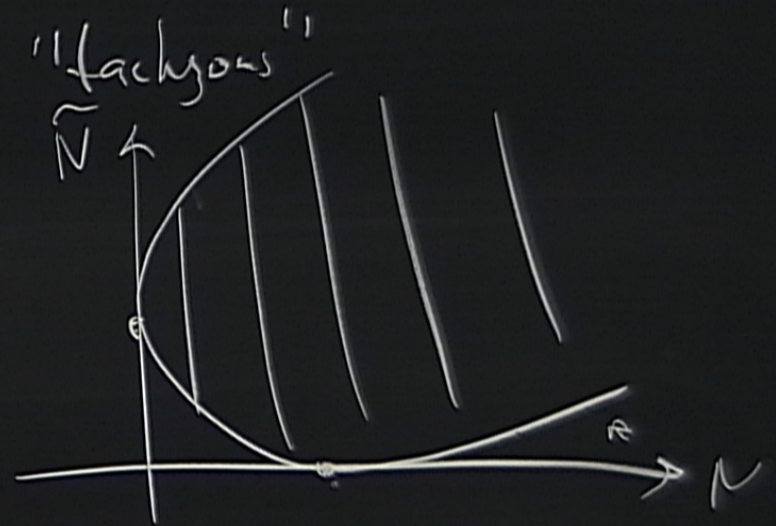


$$\Delta x_{out}^2 = \Delta x_{in}^2 + \frac{l_s^4}{\Delta x_{in}^2}$$

$$e^{i\alpha id} = e^{-i\beta \frac{1}{4}}$$

1)  $\delta t \, dv = \frac{1}{2} E l_s^2$

2) for any  $R$ ,  $\infty$  # of "factions"



$$X^0 = 1$$

$$X^1 = x$$