Orals: register two weeks in advance, and before that, agree with me on time and date via email,

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$N = 4$ SYM

Wightman axioms ✓

renormalizable ✓

has interesting IR-UV interplay!

conformally invariant!

Non-commutative QFT

QFT over non-comm. space

$USU^{\dagger} \sim \mathbb{I}$

$e^{-i\Pi}$ — conformal invariance

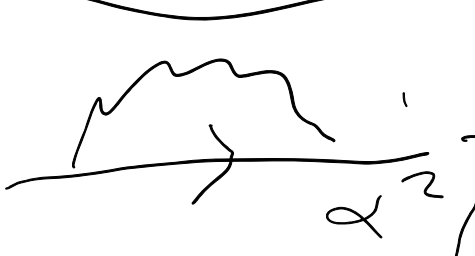
$\beta = 0$ no β-fct.

Old QFT

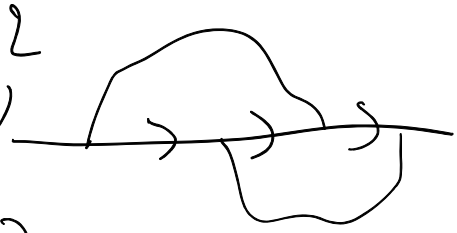
N. Baker, Ken Johnson, Willey.

QED: $\exists$ a linear covariant gauge s.t.

$Z_1 = Z_2 = 1$



Assume: $\xi \equiv \xi(\alpha) = \cancel{\xi_0} + \alpha \xi_1 + \dots$

α^2 α^2 

$+$

$\alpha^2 = 0$ $\quad \Big\} \; \alpha^2 \ln \frac{1}{\mu^2} (1 + \dots)$

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non-abelian gauge th.

$$\frac{Z_1}{Z_2} \neq 1$$

$\exists$ gauge $\xi_0 + g^2 \xi_1 + g^4 \xi_2 + \dots$

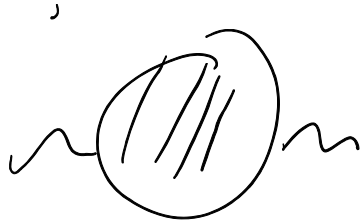
$$\frac{Z_1}{Z_2} \overset{!}{=} 1 \qquad Z_1 \neq 1 \neq Z_2$$

$$\beta_{N=4\ SYM} = \frac{Z_{\text{mix}}}{Z_{\text{ym}}\sqrt{Z_{\text{mm}}}} \qquad Z_{\text{mix}} = 1$$

$$\beta_{N=4\ SYM} = -\frac{1}{2}\,\frac{\partial \log Z_{\text{mm}}}{\partial \log \frac{q^2}{\mu^2}}$$

$$\| \qquad 0$$

Z_{mm} has no quantum corr.



has no q.c.

$\Downarrow$

rational fct.

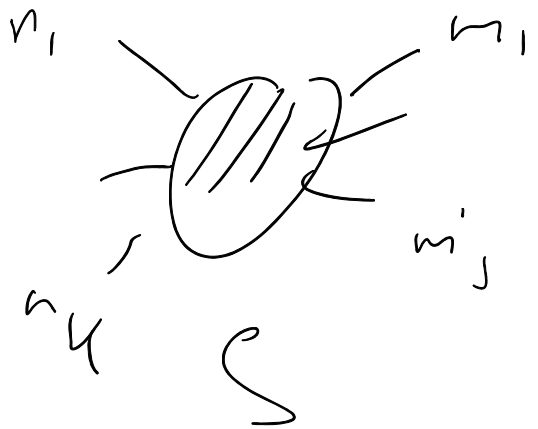
no Imaginary part

no contribution to scattering $\operatorname{Im} S = S \equiv S^\dagger$

$\Rightarrow$ gluon is free

$\Rightarrow$ everybody is free!?

Wigner's paper on rep of Poincaré group of <u>free particles</u>



$$SS^\dagger = 1$$

should become asymptotic states

$\langle -\infty | +\infty \rangle_{2pt}$

$\lim_{m \to \infty}$] after

did it for $D \leq 4$

Haag's thm

Interacting Lagrangian

can not produce

asymptotic particles

$\sim$ free particles.