Teoría de Campos 2020 - Práctica

Bilineales de Dirac.

Bilineales de Dirac

Formar escalares que transformen de manera covariante a partir de Ψ

<u>Motivación:</u>

- Obtención de un Lagrangiano
- Oberservables de la teoría

Bilineales de Dirac

$\Psi \in \mathbb{C}^4$

<u>Primera idea:</u> $\Psi^\dagger \Psi$

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¡No funciona!

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Bilineales de Dirac

$$\bar{\Psi}\Psi \xrightarrow{boost} \bar{\Psi}S(\Lambda)^{-1}S(\Lambda)\Psi$$

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$\bar{\Psi}\gamma^\mu\Psi \xrightarrow{boost} \bar{\Psi}S(\Lambda)^{-1}\gamma^\mu S(\Lambda)\Psi$ (ejercicio 13 a)

Bilineales de Dirac

$$\bar{\Psi}\Psi \xrightarrow{boost} \bar{\Psi}\Psi \quad \text{Escalar}$$

$$\bar{\Psi}\gamma^{\mu}\Psi \xrightarrow{boost} \Lambda^{\mu}_{\nu}\bar{\Psi}\gamma^{\nu}\Psi \quad \text{Vector}$$

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$\bar{\Psi}\gamma^{\mu}\gamma^{5}\Psi \xrightarrow{boost} \bar{\Psi}S(\Lambda)^{-1}\gamma^{\mu}\gamma^{5}S(\Lambda)\Psi$ (ejercicio 15 b)

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$$\bar{\Psi}\gamma^{[\mu}\gamma^{\nu]}\Psi = \frac{1}{2}\bar{\Psi}\gamma^{\mu}\gamma^{\nu}\Psi - \frac{1}{2}\bar{\Psi}\gamma^{\nu}\gamma^{\mu}\Psi$$

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$\bar{\Psi}\gamma^{[\mu}\gamma^{\nu]}\Psi \xrightarrow{boost} \Lambda^{\mu}_{\rho}\Lambda^{\nu}_{\sigma}\bar{\Psi}\gamma^{[\rho}\gamma^{\sigma]}\Psi$ Tensor antisimétrico de orden 2

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<u>Paridad:</u> $P(\Psi(\mathbf{x}, t)) = S_P \Psi(-\mathbf{x}, t), \quad S_P \neq \exp(\omega_{\mu\nu} \Sigma^{\mu\nu})$

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$$S_P = \gamma^0$$

Bilineales de Dirac

$$\gamma^5 S_P = i\gamma^0\gamma^1\gamma^2\gamma^3 S_P$$

Bilineales de Dirac

$$\gamma^5 S_P = iS_P(S_P^{-1}\gamma^0 S_P)(S_P^{-1}\gamma^1 S_P)(S_P^{-1}\gamma^2 S_P)(S_P^{-1}\gamma^3 S_P)$$

Bilineales de Dirac

$$\gamma^5 S_P = (-1)^3 i S_P \gamma^0 \gamma^1 \gamma^2 \gamma^3$$

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$\bar{\Psi}\gamma^\mu\gamma^5\Psi$ pseudo-vector

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Bilineales de Dirac: $\bar{\Psi}\Gamma\Psi$, Γ una matriz de 4×4

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$\bar{\Psi}\gamma^{[\mu}\gamma^{\nu]}\Psi$ Tensor de orden 2

$\bar{\Psi}\gamma^{[\mu}\gamma^{\nu}\gamma^{\rho]}\Psi$ Tensor de orden 3

$\bar{\Psi}\gamma^{[\mu}\gamma^{\nu}\gamma^{\rho}\gamma^{\sigma]}\Psi$ Tensor de orden 4

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