

Title: Lecture - QFT I, PHYS 601

Speakers: Gang Xu

Collection/Series: Quantum Field Theory I (Core), PHYS 601, October 7 - November 6, 2024

Subject: Condensed Matter, Particle Physics, Quantum Fields and Strings

Date: October 25, 2024 - 9:00 AM

URL: <https://pirsa.org/24100034>

Interactions

Amuse-bouche of QED $A_\mu \rightarrow A_\mu + \partial_\mu \alpha$

$$j^\mu = \bar{\psi} \gamma^\mu \psi$$

gauge symmetry

$$F^{\mu\nu} F_{\mu\nu}$$

$$\mathcal{L}_{int} = \bar{\psi} \gamma^\mu \psi A_\mu$$


$$\bar{\psi} \gamma^\mu \psi A_\mu$$

$$\bar{\psi} \gamma^\mu \psi A_\mu \rightarrow \bar{\psi} \gamma^\mu \psi A_\mu + \underline{\bar{\psi} \gamma^\mu \psi \partial_\mu \alpha} \leftarrow \text{not invariant}$$

gauge the global symmetry
local

$$\mathcal{L} = \bar{\psi} (i \not{\partial} - m) \psi$$

$$\psi \rightarrow \left(\psi e^{-i \overset{\text{gauge}}{\alpha(x)} Q} \right) \quad \text{global}$$

$$\bar{\psi} i \gamma^\mu \partial_\mu \psi = \bar{\psi} e^{+i \alpha(x) Q} i \gamma^\mu \partial_\mu \psi e^{-i \alpha(x) Q} + \bar{\psi} i \gamma^\mu (-i (\partial_\mu \alpha) Q) \psi$$

$$Q \bar{\psi} \gamma^\mu \psi (\partial_\mu \alpha)$$

$$\mathcal{L} = \bar{\psi}(i\not{D} - m)\psi - Q\bar{\psi}A_{\mu}\gamma^{\mu}\psi$$

$$= \bar{\psi}(i\not{D} - QA)\psi - m\bar{\psi}\psi$$

$$\int_{\text{QED}} \bar{\psi}(i\not{D} - m)\psi$$

$$D_{\mu} = \partial_{\mu} + iQA_{\mu}$$

apple: rotation symmetry -

: stem

: skin is smooth

taste sweet or tart

$$\mathcal{L} = \bar{\psi}(i\not{D} - m)\psi - Q\bar{\psi}A_{\mu}\gamma^{\mu}\psi$$

$$= \bar{\psi}(i\not{D} - Q\not{A})\psi - m\bar{\psi}\psi$$

$$\int_{\text{QED}} \bar{\psi}(i\not{D} - m)\psi$$

$$D_{\mu} = \partial_{\mu} + iQA_{\mu}$$

apple: rotation symmetry -

: stem

: skin is smooth X $\rightarrow$ pineapple

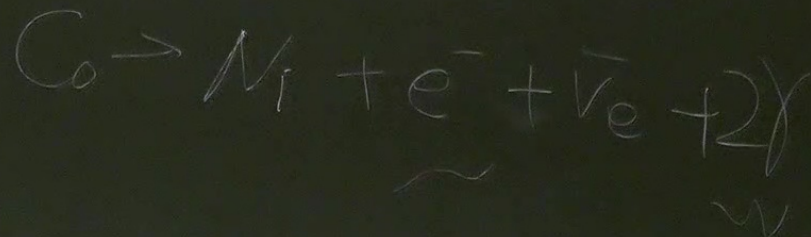
taste sweet or tart

detective

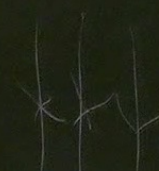
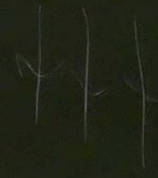
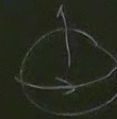
PU 4C3RW YpF

Year 2024

Year 2023 CS Wu discover cobalt



0.00036 micron



mirror
predecessor

mystery: what kind of
interactions allow
parity violation.