Title: QFT1 Lecture - 102723

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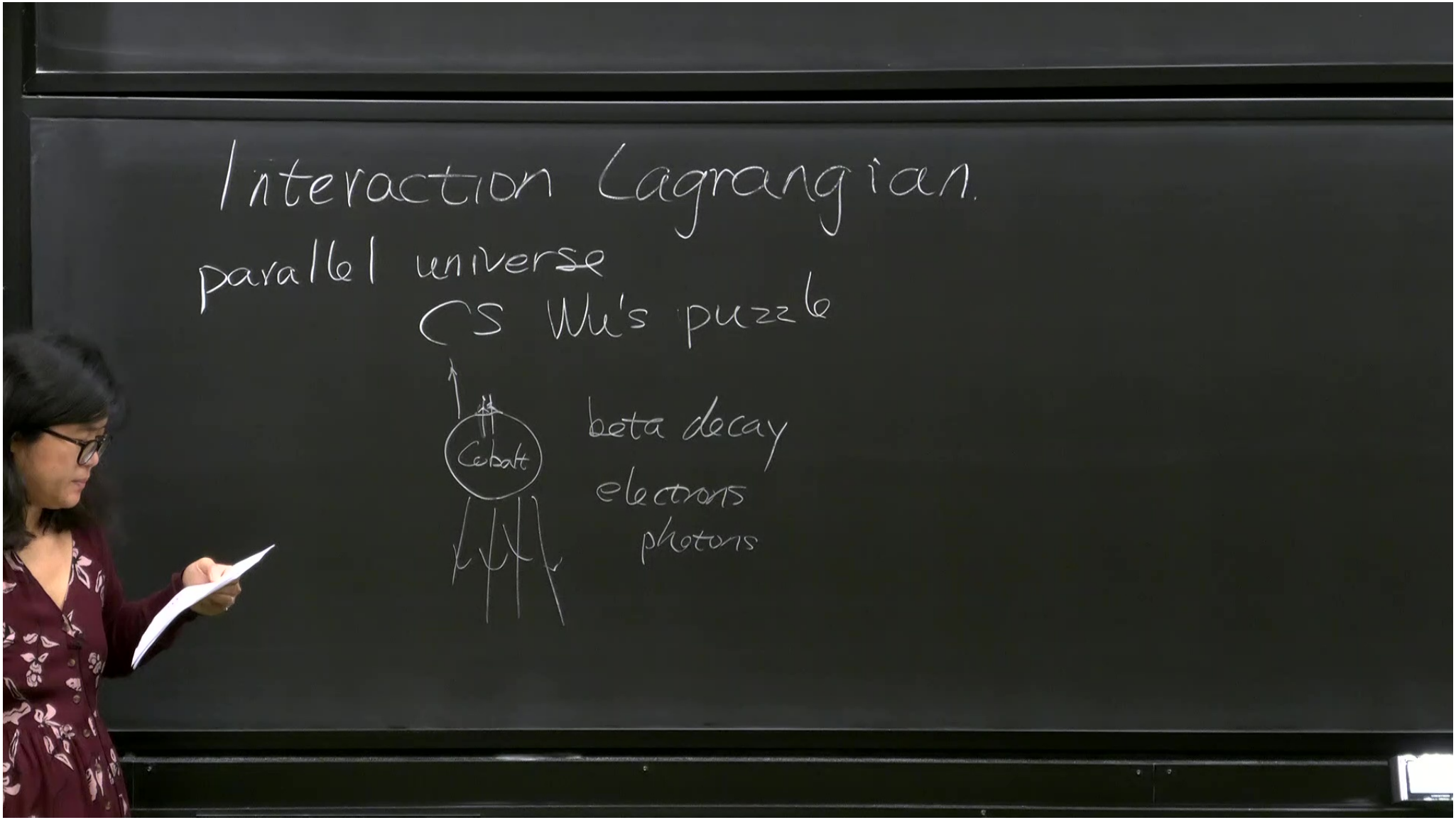
Collection: Quantum Field Theory 1 2023/24

Date: October 27, 2023 - 10:45 AM

URL: https://pirsa.org/23100053


Interaction Lagrangian
parallel universe
CS Wu's puzzle
Cobalt
beta decay
electrons
photons

angian.

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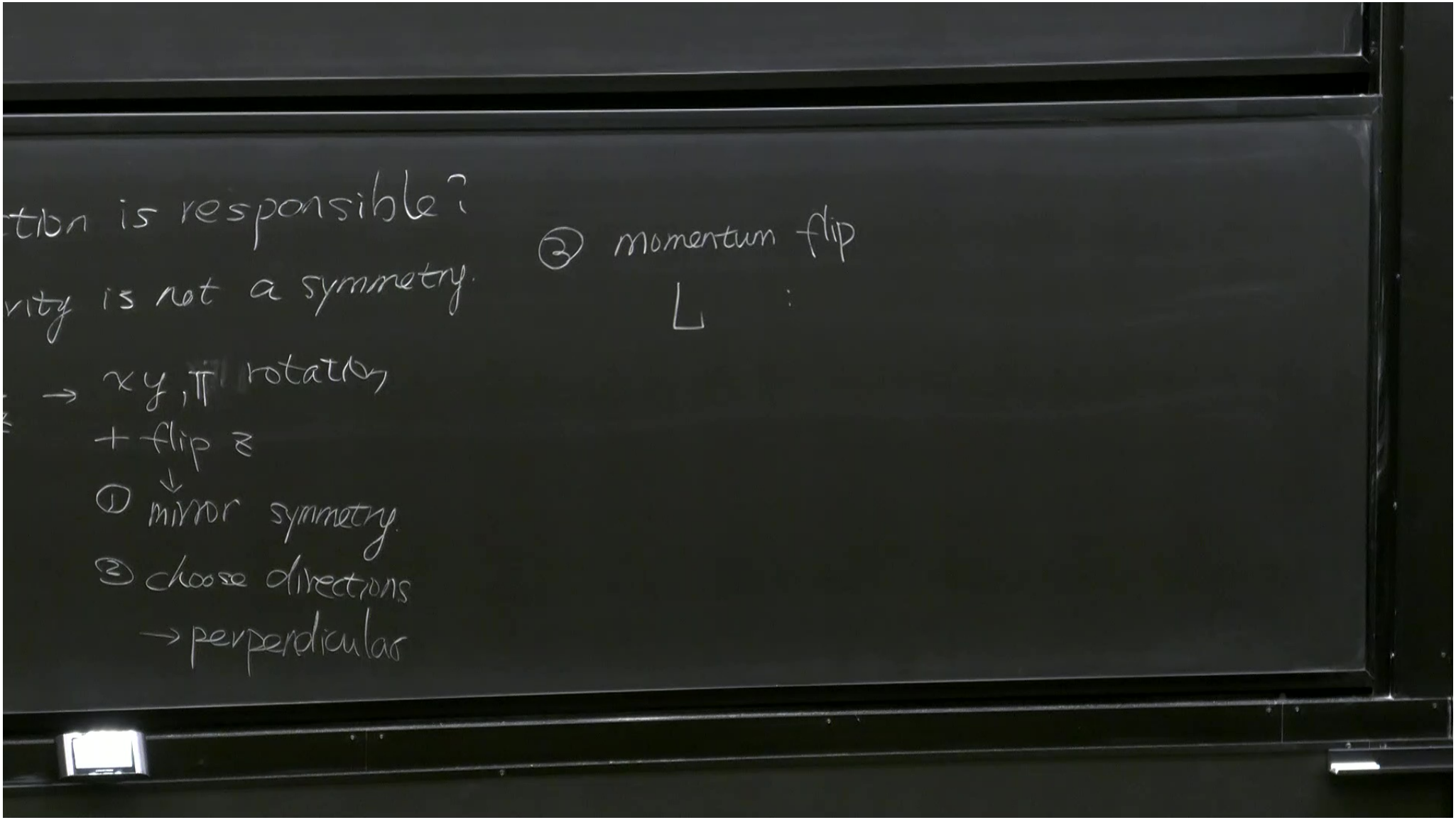
• which interaction is responsible?

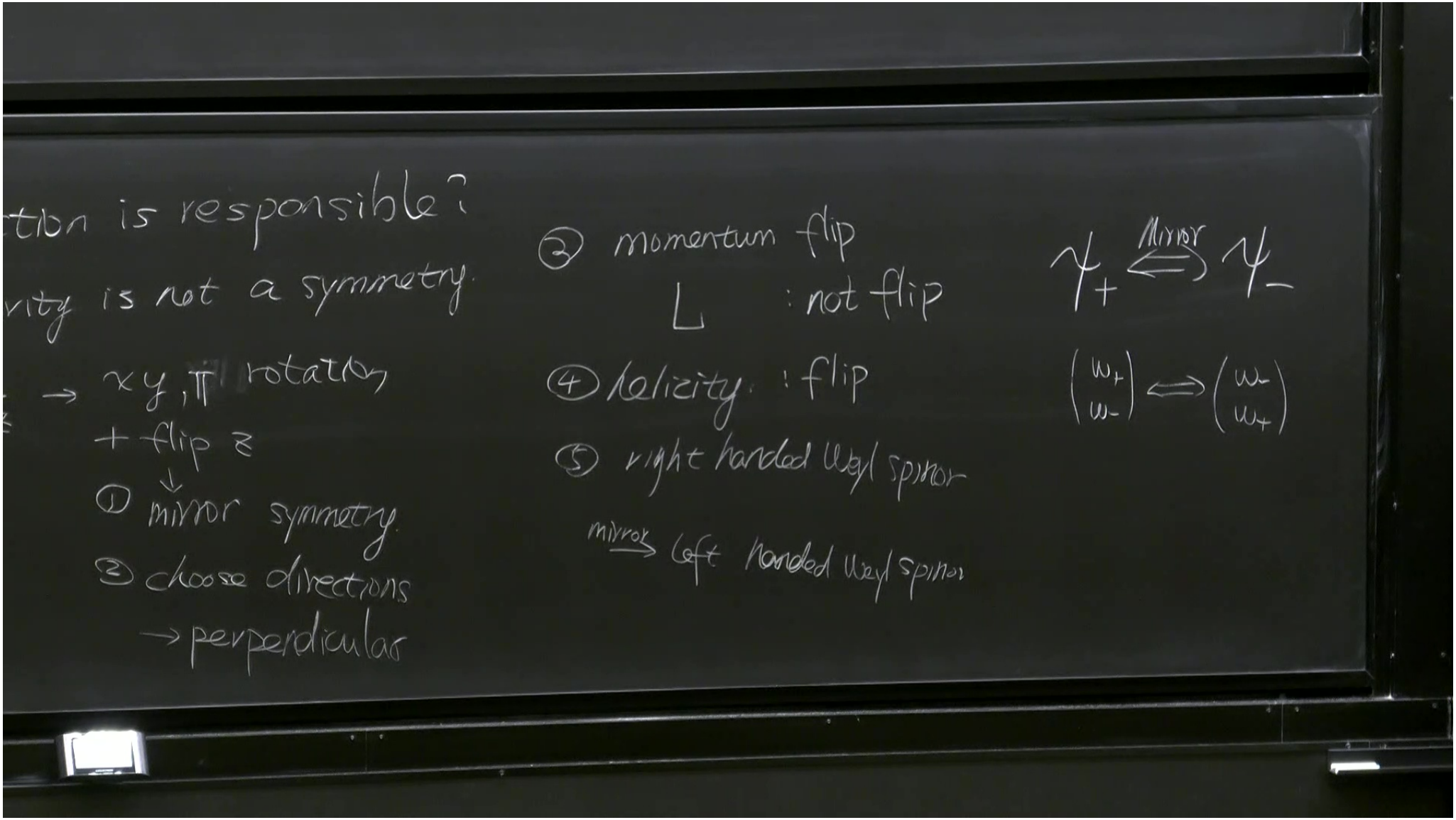
conclusion: Parity is not a symmetry.

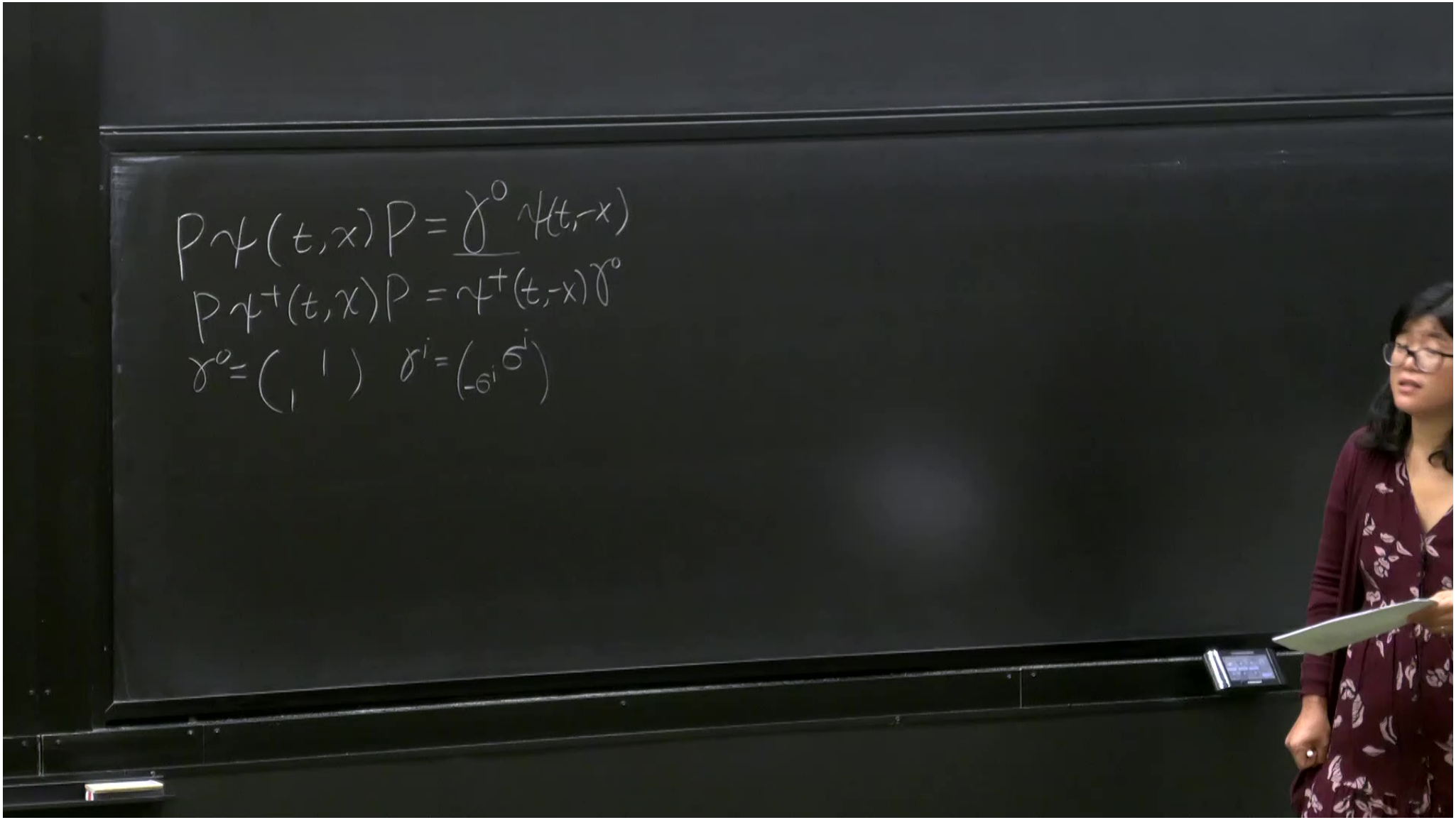
$\begin{cases} x \to x \\ y \to -y \\ z \to -z \end{cases}$ → xy, π rotation + flip z

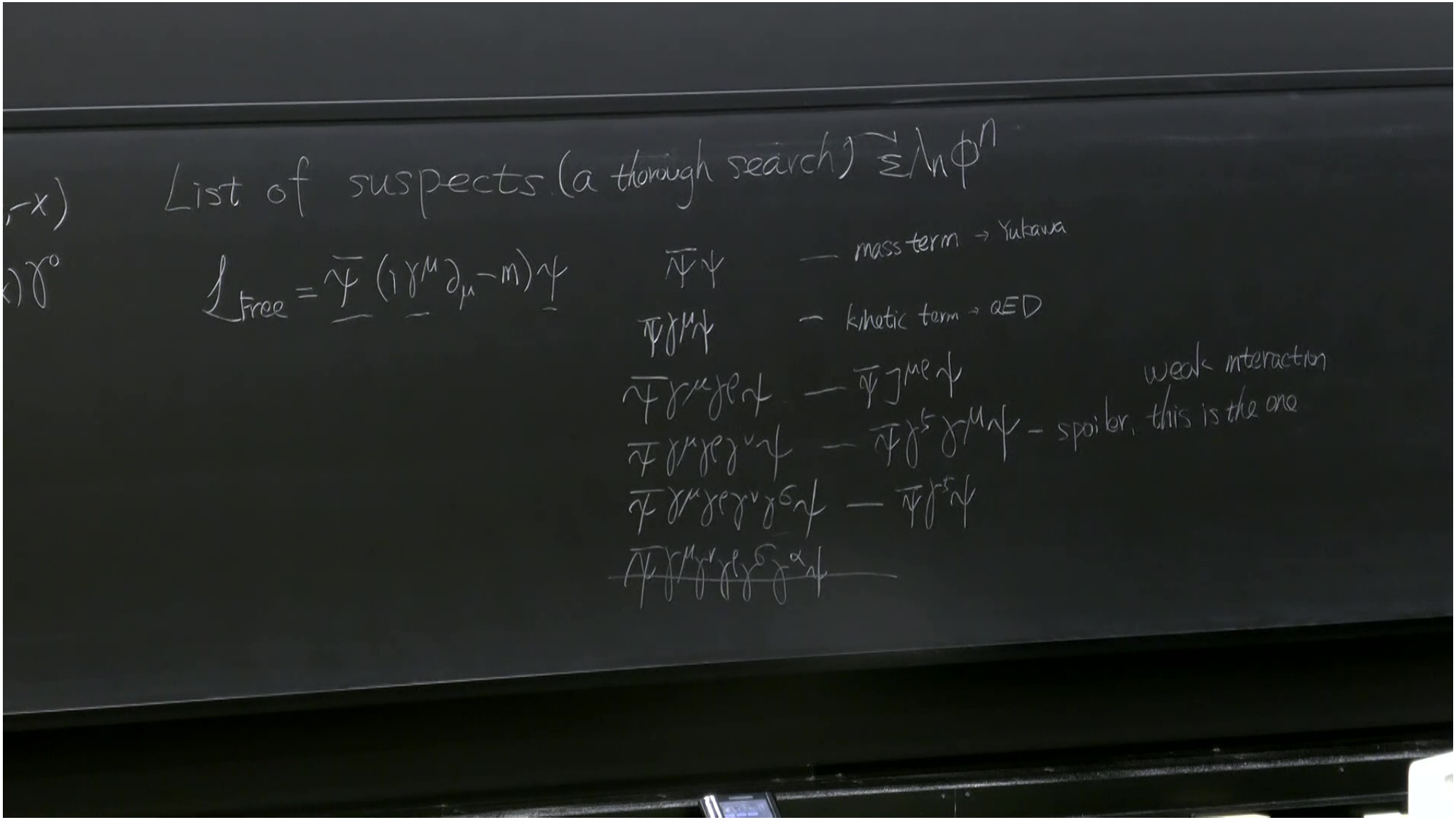
① mirror symmetry.

②


tion is responsible?
rity is not a symmetry.
→ xy, π rotation
+ flip z
① mirror symmetry
② choose directions
→ perpendicular
② momentum flip
L :


tion is responsible?
rity is not a symmetry.
→ xy, π rotation
+ flip z
↓
① mirror symmetry.
② choose directions
→ perperdicular
② momentum flip
L : not flip
④ helicity : flip
⑤ right handed Weyl spinor
mirror → left handed Weyl spinor
ψ+ Mirror ψ−
(w+ w−) ⟺ (w− w+)


$P\psi(t,x)P = \gamma^0 \psi(t,-x)$
$P\psi^\dagger(t,x)P = \psi^\dagger(t,-x)\gamma^0$
$\gamma^0 = \begin{pmatrix} & 1 \\ 1 & \end{pmatrix}$ $\gamma^i = \begin{pmatrix} & \sigma^i \\ -\sigma^i & \end{pmatrix}$


List of suspects (a thorough search)
$\mathcal{L}_{Free} = \bar{\psi}(i\gamma^\mu\partial_\mu - m)\psi$
$\bar{\psi}\psi$ — mass term → Yukawa
$\bar{\psi}\gamma^\mu\psi$ — kinetic term → QED
$\bar{\psi}\gamma^\mu\gamma^e\psi$ — $\bar{\psi}J^{me}\psi$
$\bar{\psi}\gamma^\mu\gamma^e\gamma^\nu\psi$ — $\bar{\psi}J^5\gamma^\mu\psi$ - spoiler, this is the one
$\bar{\psi}\gamma^\mu\gamma^e\gamma^\nu\gamma^5\psi$ — $\bar{\psi}J^5\psi$
weak interaction

$$\bar{\psi}\psi\psi P$$

$$= P\psi^{\dagger}\gamma^{0}\psi P$$

$$= P\psi^{\dagger}P\,\gamma^{0}P\psi P$$

$$= \psi^{\dagger}(t,-x)\,\gamma^{0}\gamma^{0}\gamma^{0}\,\psi(t,-x)$$

$$= \bar{\psi}(t,-x)\psi(t,-x)$$

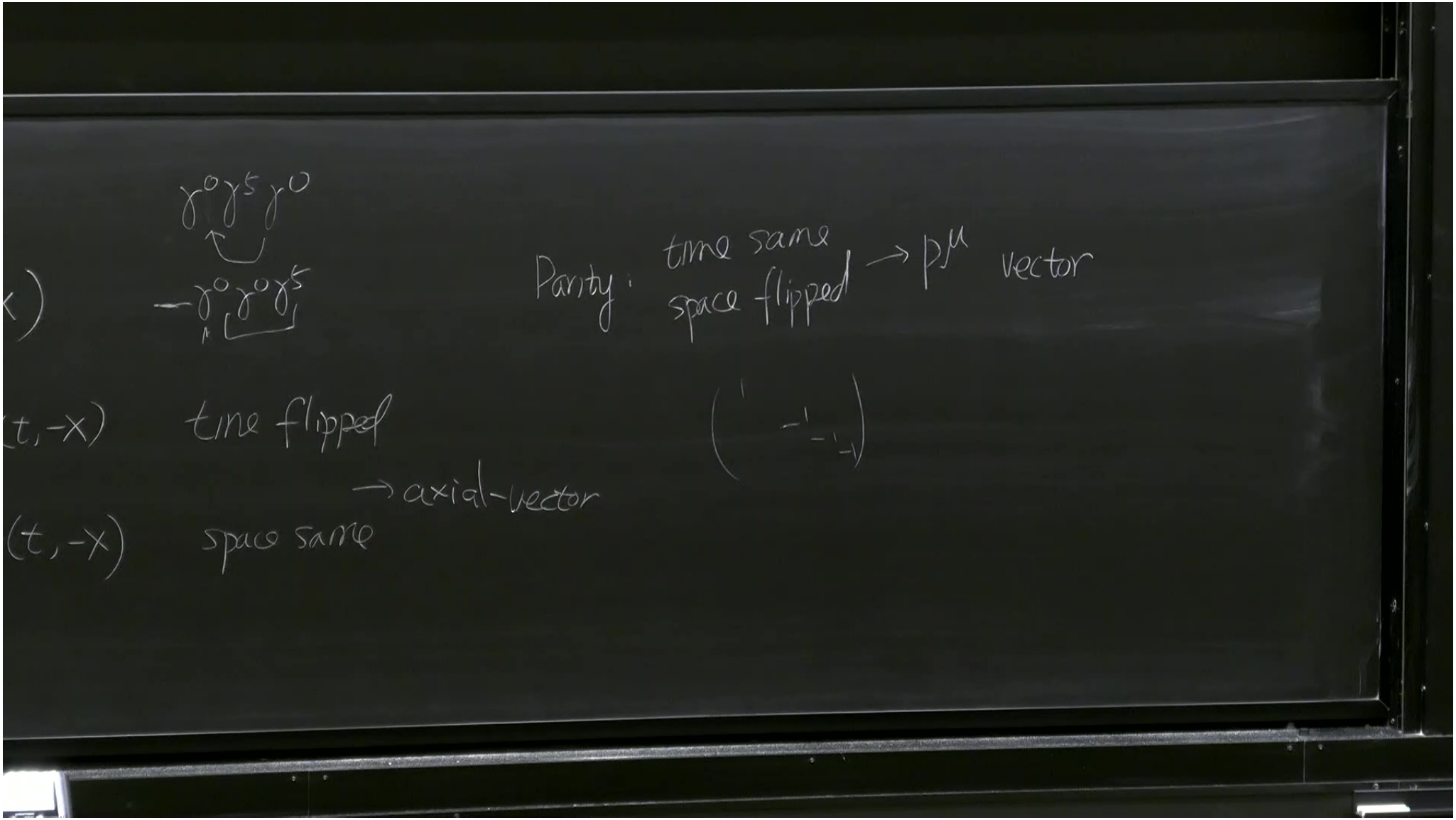
$$P \psi^\dagger \gamma^0 \gamma^\mu \gamma^5 \psi P$$

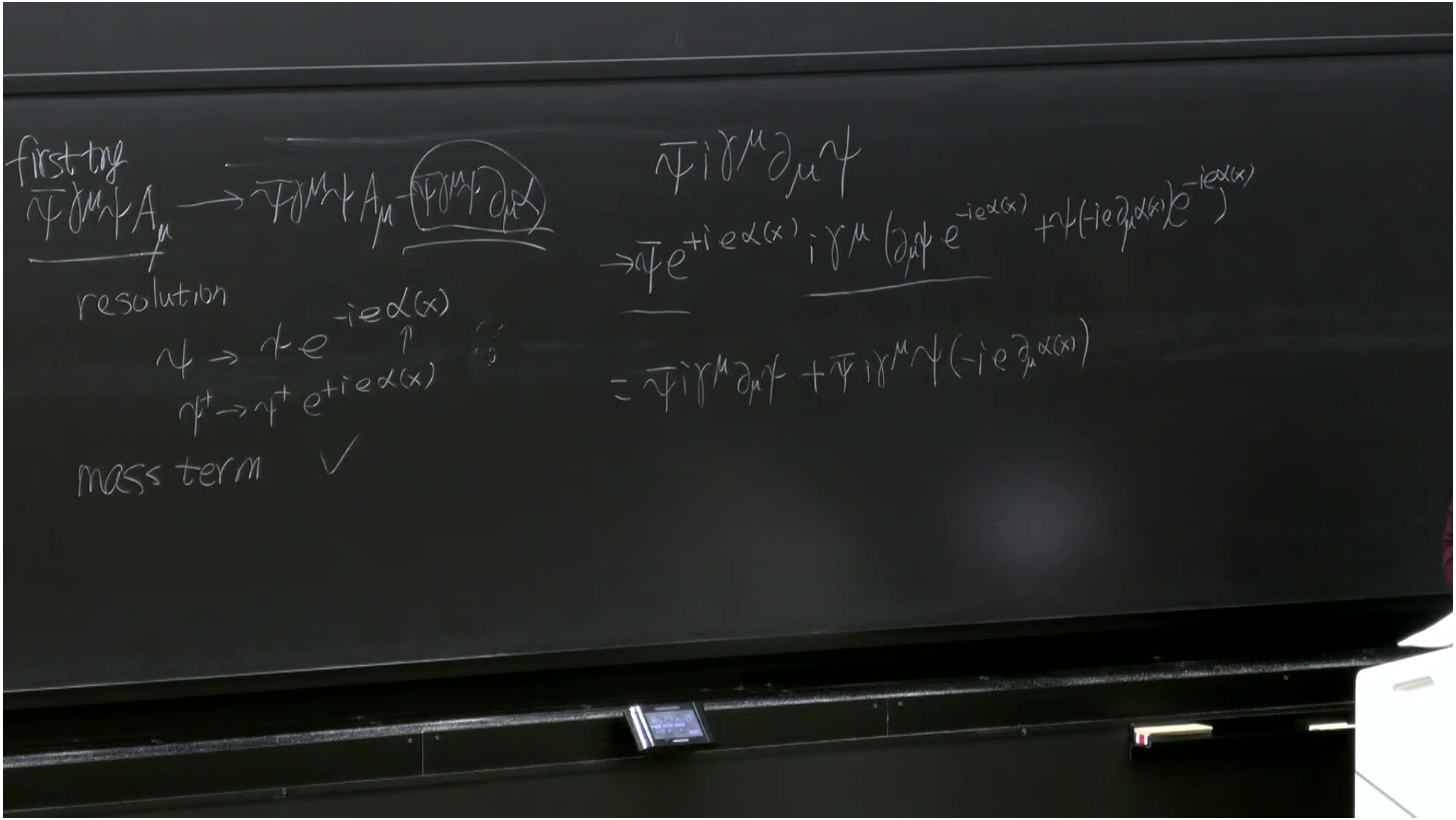
$$= \psi^\dagger(t,-x) \gamma^0 \gamma^0 \gamma^\mu \gamma^5 \gamma^0 \psi(t,-x)$$

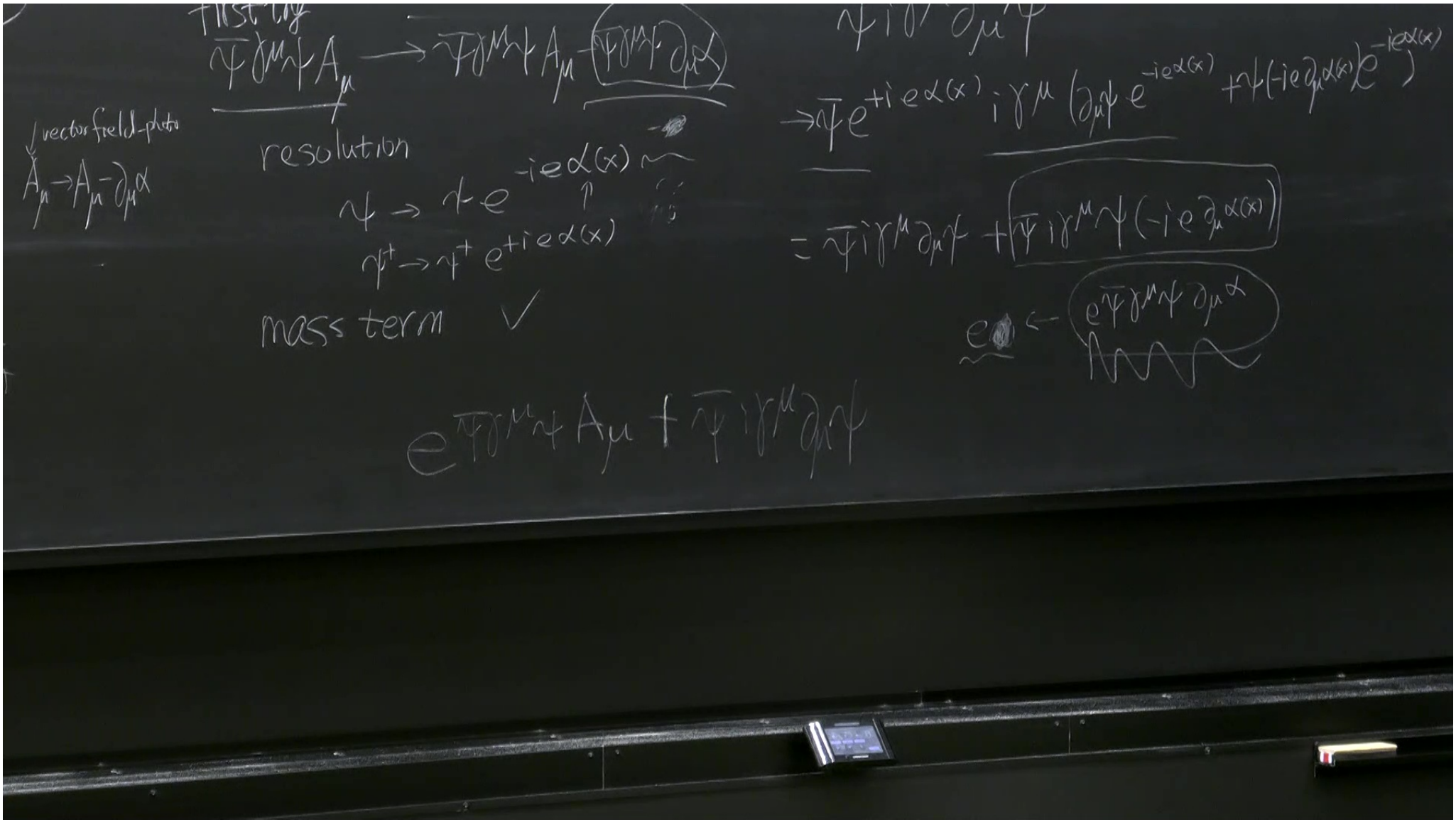
$$\begin{cases} \mu = 0 & -\bar{\psi}(t,-x) \gamma^0 \gamma^5 \psi(t,-x) \\ \mu = i & +\bar{\psi}(t,-x) \gamma^i \gamma^5 \psi(t,-x) \end{cases}$$

$\gamma^0 \psi(t,-x)$

$x)$


$\gamma^0\gamma^5\gamma^0$
$-\gamma^0\gamma^0\gamma^5$
Parity: time same
space flipped → pV vector
time flipped
→ axial-vector
space same


first try
resolution
mass term


vector field photon
resolution
mass term

$\bar{\Psi}\, i(\partial_\mu + ieA_\mu)\gamma^\mu \Psi$

D_μ $\quad \bar{\Phi}^+\Phi$

$= \bar{\Psi}(iD_\mu\gamma^\mu - m)\Psi$ $\quad - i D_\mu \bar{\Phi}^+ D^\mu \Phi$

apple. rotate

eat apple skin

has a stem

red