Report problem

- Mandatory:

  (1) Explain the two equalities marked ! in page 5 of the additional note (a) for Lecture 8 (copied in the next page).

  (2) Show that the Standard Model has no gauge anomaly.

- Optional:

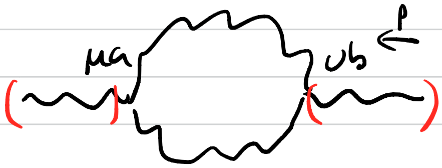
  You may also do some of the exercises shown in the lecture or in the additional notes in the course website

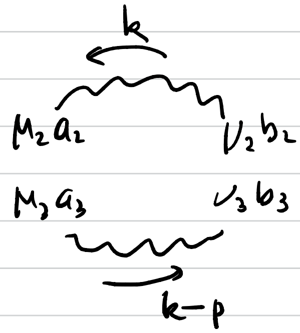
  https://member.ipmu.jp/kentaro.hori/Courses/EPP/

  or create your own problems and solve them.

Submit your report via UTOL.

Deadline: 23:59, August 2, 2024



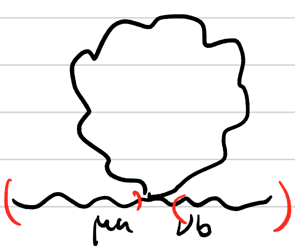
$$= \frac{1}{2}\, \mu_{DR}^{4-d} \int \frac{d^dk}{(2\pi)^d}\, V^{\mu a\ \mu_2 a_2\ \mu_3 a_3}_{p,\ -k,\ k-p}$$  $$V^{\nu_2 b_2\ \nu_3 b_3\ \nu b}_{k,\ -(k-p),\ -p}$$

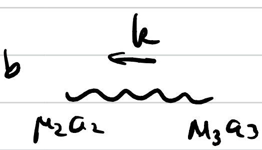
$$\overset{!}{=} \frac{1}{2} \mathrm{tr}_g(\mathrm{ad}\, e^a\, \mathrm{ad}\, e^b)\, \mu_{DR}^{4-d} \int \frac{d^dk}{(2\pi)^d} \frac{1}{k^2 (k-p)^2} \times$$

$$\Big(-\delta^{\mu\nu}(k+p)^2 + (k+p)^\mu (2k-p)^\nu - (k-2p)^\mu (k+p)^\nu$$

$$+ (2k-p)^\mu (k+p)^\nu - d\,(2k-p)^\mu (2k-p)^\nu + (2k-p)^\mu (k-2p)^\nu$$

$$- (k+p)^\mu (k-2p)^\nu + (k-2p)^\mu (2k-p)^\nu - \delta^{\mu\nu} (k-2p)^2 \Big)$$



$$= \frac{1}{2}\, \mu_{DR}^{4-d} \int \frac{d^dk}{(2\pi)^d}\, V^{\mu a,\ \mu_2 a_2,\ \mu_3 a_3,\ \nu b}$$ 

$$\overset{!}{=} \frac{1}{2} \mathrm{tr}_g(\mathrm{ad}\, e^a\, \mathrm{ad}\, e^b)\, \mu_{DR}^{4-d} \int \frac{d^dk}{(2\pi)^d}\, \delta^{\mu\nu} (d-1) \frac{2}{k^2}$$

$$\frac{2}{k^2} \sim \frac{1}{k^2} + \frac{1}{(k-p)^2} = \frac{(k-p)^2 + k^2}{k^2 (k-p)^2}$$