

## Notation comparisons

I list here some definitions which may differ among textbooks and my notes.

| Quantity  | Peskin | My notes                 | Bailin and Love | Abers and Lee | Bjorken and Drell | Weinberg QFT | Weinberg Gravity | Kaku |
|---|--------|--------------------------|-----------------|---------------|-------------------|--------------|------------------|------|
| $g_{\mu\nu} = s_\eta(1, -1, -1, -1), \quad s_\eta =$<br>$\epsilon^{0123}$                 | +1     | +1                       |                 |               | +1                | -1           | -1               | +1   |
| $\tilde{f}(k)$  | 1      | $\int d^4x e^{ikx} f(x)$ |                 |               | 1                 |              |                  |      |
| $F_{\mu\nu}^{\text{Abelian}} = s_F(\partial_\mu A_\nu - \partial_\nu A_\mu), \quad s_F =$ | +1     |                          | +1              | +1            | -1                | +1           | +1               |      |
| $\vec{E}_x = s_E F^{01}, \quad s_E =$   | -1     |                          |                 |               | +1                |              | +1               |      |
| $\vec{B}_z = s_B F^{12}, \quad s_B =$   | -1     |                          |                 |               | +1                |              | +1               |      |
| $\partial_\mu F^{\mu\nu} = s_J j^\nu, \quad s_J =$  |        | $e, e < 0$               |                 |               |                   |              | -1               |      |
| $\mathcal{L} = -\frac{1}{4} F^{\mu\nu} F_{\mu\nu} + s_A A_\mu J^\mu, \quad s_A =$         |        |                          |                 |               | $-e_0$            | +1           |                  |      |

Everyone agrees that  $A^0 = \phi$  and  $\vec{E} = -\vec{\nabla}\phi + \dots$  which requires  $s_E s_\eta s_F = -1$ .

| Quantity   | Peskin   | My notes   | Bailin/Love   | Abers and Lee                                       |
|--|--|--|---|---|
| $\tilde{f}(k)$   | $\int d^4x e^{ikx} f(x)$   |  |   |   |
| $A^0$  | $\frac{Q}{4\pi r}$   |  |   |   |
| $\sigma^\mu$   | $(1, \vec{\sigma}), \bar{\sigma}^\mu = \sigma_\mu$                     |  |   |   |
| $\gamma^\mu$   | $\begin{pmatrix} 0 & \sigma^\mu \\ \bar{\sigma}^\mu & 0 \end{pmatrix}$ |  |   |   |
| $\gamma^5$   | $i\gamma^0\gamma^1\gamma^2\gamma^3$                                    |  | $i\gamma^0\gamma^1\gamma^2\gamma^3$                 |   |
| $\sum_s u(p)\bar{u}(p) =$                                    | $p_\mu\gamma^\mu + m$  |  |   |   |
| lattice spacing  | $\epsilon$   | $a$  |   |   |
| $g_L$  | $U(x', x) = e^{+ig\epsilon A_\mu^a t^a}$                               | $e^{iaA_\mu}$                                      |   |   |
| gauge trsf   | $V(x) = e^{i\alpha^a(x)t^a}$   | $e^{i\lambda(x)}, \lambda = \lambda^{(b)}L_b$      | $e^{-ig\mathbf{T}\cdot\Lambda(x)}$                  | $e^{-i\mathbf{L}\cdot\theta}$                       |
| $D_\mu$  | $\partial_\mu - igA_\mu^a t^a$   | $\partial_\mu - iA_\mu^{(b)}M(L_b)$                | $\partial_\mu + ig\mathbf{T}\cdot A_\mu$            | $\partial_\mu - ig\mathbf{L}\cdot \mathbf{A}_\mu$   |
| $A_\mu \xrightarrow{\text{gauge}}$                           | $V\left(A_\mu^a + \frac{i}{g}\partial_\mu\right)V^\dagger$             | $e^{i\lambda}(A_\mu + i\partial_\mu)e^{-i\lambda}$ | $U(x)(A_\mu(x) - \frac{i}{g}\partial_\mu)U^{-1}(x)$ | $U(A_\mu(x) + \frac{i}{g}\partial_\mu)U^{-1}(x)(?)$ |
| $F_{\mu\nu} = \partial_\mu A_\nu^a - \partial_\nu A_\mu^a +$ | $+gf^{abc}A_\mu^b A_\nu^c = -ig[A_\mu, A_\nu]$                         | $-i[A_\mu, A_\nu]$                                 | $+ig[A_\mu, A_\nu]$                                 | $+gc^{ijk}A_\mu^j A_\nu^k$                          |
| $[D_\mu, D_\nu]$   | $-igF_{\mu\nu}^a t^a$  | $-iF_{\mu\nu}$                                     | $igF_{\mu\nu}$                                      |   |
| Lie alg  | $if^{abc}T^c$  | $ic_{ab}^c L_c$                                    | $if^{abc}T^c$                                       |   |

Everyone agrees  $\mathcal{L} = -\frac{1}{4}F_{\mu\nu}^a F_a^{\mu\nu} + \bar{\psi}(i\not{D} - m)\psi$ . I think everyone agrees  $\alpha = e^2/4\pi\hbar c$ .

Notation Comparisons, More Books

| Quantity   | Peskin   | Bjorken and Drell   | Weinberg   | Kaku   |
|--|--|---|--|--|
| $g_{\mu\nu}$ (or $\eta_{\mu\nu}$ )<br>$\epsilon^{0123}$<br>$\tilde{f}(k)$<br>$A^0$<br>$\sigma^\mu$<br>$\gamma^\mu$<br>$\gamma^5$<br>$\sum_s u(p)\bar{u}(p) =$                          | $(1, -1, -1, -1)$<br>$1$<br>$\int d^4x e^{ikx} f(x)$<br>$\frac{Q}{4\pi r}$<br>$(1, \vec{\sigma}), \bar{\sigma}^\mu = \sigma_\mu$<br>$\begin{pmatrix} 0 & \sigma^\mu \\ \bar{\sigma}^\mu & 0 \end{pmatrix}$<br>$i\gamma^0\gamma^1\gamma^2\gamma^3$<br>$p_\mu\gamma^\mu + m$         | $(1, -1, -1, -1)$<br><br><br><br><br><br><br><br><br>$\frac{p_\mu\gamma^\mu + m}{2m}$ | $(-1, 1, 1, 1)$<br>$1$<br><br><br><br>$\{\gamma^\mu, \gamma^\nu\} = 2\eta_{\mu\nu}$<br>$i\gamma_0\gamma_1\gamma_2\gamma_3$ | $\eta = (1, -1, -1, -1)$<br><br><br><br><br><br><br><br><br>$\frac{p_\mu\gamma^\mu + m}{2m}$ |
| lattice spacing<br>$g_L$<br>gauge trsf<br>$D_\mu$<br>$A_\mu \xrightarrow{\text{gauge}}$<br>$F_{\mu\nu} = \partial_\mu A_\nu^a - \partial_\nu A_\mu^a +$<br>$[D_\mu, D_\nu]$<br>Lie alg | $\epsilon$<br>$U(x', x) = e^{+ig\epsilon A_\mu^a t^a}$<br>$V(x) = e^{i\alpha^a(x)t^a}$<br>$\partial_\mu - igA_\mu^a t^a$<br>$V\left(A_\mu^a + \frac{i}{g}\partial_\mu\right)V^\dagger$<br>$+gf^{abc}A_\mu^b A_\nu^c = -ig[A_\mu, A_\nu]$<br>$-igF_{\mu\nu}^a t^a$<br>$if^{abc}T^c$ |   |  |  |