



PPPI HS09

Exercise Sheet 11

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Exercise 25 [*Fierz Identity*]

Show that the Fierz Identity holds in the fundamental representation of SU(N):

$$\sum_a T_{ij}^a T_{kl}^a = T_F \left(\delta_{il} \delta_{kj} - \frac{1}{N} \delta_{ij} \delta_{kl} \right). \quad (1)$$

Exercise 26 [*Field Strength Tensor*]

For an SU(N) gauge theory, show that

$$[D_\mu, D_\nu] = ig F_{\mu\nu}^a T^a \quad \text{with} \quad F_{\mu\nu}^a = \partial_\mu A_\nu^a - \partial_\nu A_\mu^a - gf^{abc} A_\mu^b A_\nu^c. \quad (2)$$

Exercise 27 [*Field Strength Tensor II*]Show that $F_{\mu\nu}^a$ transforms in the adjoint representation of SU(N), i.e. that:

$$F_{\mu\nu}^a \longrightarrow F_{\mu\nu}^a - gf^{abc} \alpha^b F_{\mu\nu}^c. \quad (3)$$