

1. Let f^{abc} be the structure constants of $SU(N_c)$:

$$[T^a, T^b] = if^{abc}T^c.$$

Show that f^{abc} are antisymmetric with respect to all permutations of the indices.

2. What are the classical equations of motion corresponding to non-abelian gauge theory lagrangian density

$$\mathcal{L} = -\frac{1}{4}F_{\mu\nu}^a F^{a\mu\nu}.$$

3. In the lectures we introduced the “Wilson line” $\tilde{U}(x_1, x_2)$, which acts as a parallel transporter of gauge variant quantities between x_1 and x_2 . It can also be derived as follows: consider function $W(x_1, x_2) \in SU(N_c)$ which obeys

$$\begin{aligned} D_\mu(x_1)W(x_1, x_2) &= 0 \\ W(x_1, x_1) &= 1 \end{aligned}$$

- a) Write the formal solution for W .
b) Show that W transforms in gauge transformations as

$$W(x_1, x_2) \longrightarrow U(x_1)W(x_1, x_2)U^\dagger(x_2).$$