
Quantum Field Theory 2 – Tutorial 7

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Problem 1: Bianchi identity

Consider the covariant derivative in the adjoint representation

$$D_\mu^{ac} = \partial_\mu \delta^{ac} + g f^{abc} A_\mu^b. \quad (1)$$

Show that the field strength tensor,

$$F_{\mu\nu}^a = \partial_\mu A_\nu^a - \partial_\nu A_\mu^a + g f^{abc} A_\mu^b A_\nu^c, \quad (2)$$

satisfies the Bianchi identity

$$\epsilon^{\mu\nu\lambda\sigma} (D_\nu F_{\lambda\sigma})^a = 0. \quad (3)$$

What is the analogue of this equation for an Abelian gauge theory?

Hint: You may want to use the identity

$$f^{ade} f^{bcd} + f^{bde} f^{cad} + f^{cde} f^{abd} = 0.$$