
Quantum Field Theory 2 – Tutorial 11

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Problem 1: Casimir operator 3

In $SU(2)$ the generators in the fundamental representation are directly related to the Pauli matrices,

$$t_2^a = \frac{\sigma^a}{2}.$$

They satisfy $\text{tr } t_2^a t_2^b = \frac{1}{2} \delta^{ab} = C(2) \delta^{ab}$. What is the value of $C_2(2)$? Use

$$d(r)C_2(r) = d(G)C(r),$$

In $SU(N)$ the generators in the fundamental representation ($N \times N$ dimensional) satisfy

$$\text{tr}[t_N^a t_N^b] = \frac{1}{2} \delta^{ab}.$$

What is the value of $C_2(N)$?