

Homework Set QFT

Due Date: Before 5pm Friday February 18th

1) Find the generators of the “Little Group” for Massive particles (5 points)

2) Find the generators of the “Little Group” for Massless particles (5 points)

3) Show that $\int d^3\vec{p} \equiv \int \frac{d^3\vec{p}}{2E_p}$ is Lorentz invariant. (2 points)

(Hint: $\int d^4p \delta(E^2 - (|\vec{p}|^2 + m^2))$ is clearly Lorentz invariant.)

4) Anti-Particles (5 points)

- a) Expand $\Phi^{\dagger 2}\Phi^2$ in terms of a , a^\dagger , b , and b^\dagger (Ignore the exponentials and integrals)
- b) Sketch diagrams of the processes that each term corresponds to.
- c) Let the charge (Q) of particle a be q_a and the charge of particle b be q_b . Calculate ΔQ for each process.
- d) What happens if you take $q_a = -q_b$?