

Physics 215C QFT Spring 2017 Assignment 6

Due 12:30pm Wednesday, May 17, 2017

1. **Brain-warmer.**

Show that in a coherent state $|\phi\rangle$ the particle number statistics

$$P(n) \propto \langle n|\phi\rangle$$

are given by the Poisson distribution. Find the mean and variance.

2. **Chiral anomaly in two dimensions.**

Consider a massive relativistic Dirac fermion in 1+1 dimensions, with

$$S = \int dx dt \bar{\psi} (\mathbf{i}\gamma^\mu (\partial_\mu + eA_\mu) - m) \psi.$$

By heat-kernel regularization of its expectation value, show that the divergence of the axial current $j_\mu^5 \equiv \mathbf{i}\bar{\psi}\gamma_\mu\gamma^5\psi$ is

$$\partial_\mu j_\mu^5 = 2im\bar{\psi}\gamma^5\psi + \frac{e}{2\pi}\epsilon_{\mu\nu}F^{\mu\nu}.$$