

QFT Problem Set 2 - Due March 5

You should read chapters 11-13 more carefully now. As usual, *problems* are for extra credit seekers, although everyone should look at them.

1. **Anyons from Chern-Simons** We already saw the abelian Chern-Simons theory in 2 + 1 dimensions, with action

$$S = \int d^3x \epsilon^{\mu\alpha\beta} A_\mu \nabla_\alpha A_\beta \quad (1)$$

Now study a pair of particles (bosons or fermions) charged under this Chern-Simons theory (just as electrons are charged under electromagnetism). Show that as we rotate one of the particles around the other, the wavefunction picks up a phase, independent of the distance between the particles. Thus particles in 2+1 dimensions charged under an abelian Chern-Simons theory are anyons, with their fractional phase determined by their coupling to A_μ .

2. **Book Problems** 11.4, 11.5, 11.6, 11.9, 13.3, *11.7*, *14.2*