PHY 513: HW 12 (due tue 12/8/09)

1 Bhabha Scattering

Solve **PS** prob 5.2.

The problem can be divided up as follows:
a) Write the two diagrams that contribute to $e^-e^+ \to e^-e^+$ scattering and determine the corresponding amplitudes. Be careful about the sign of the amplitudes.
b) Square the amplitude and average over spins.

Details: First square each of the two diagrams by themselves; these are computations we have already done in class. Then compute the interference terms from the two diagrams. This is a genuinely new computation. When evaluating the traces you will need the result of HW5 prob 2. Finally, assemble the contributions to the amplitude squared and write the result in terms of Mandelstam variables.
c) Determine the differential cross-section. First write the result in terms of Mandelstam variables, as in the problem text. Then rewrite the Mandelstam variables in terms of the kinematical variables $E_{\rm cm}$ and θ. You need not plot the final result.

2 Quantum Statistical Mechanics

Solve **PS** prob 9.2, question b+d.

In question d) you may need the product formula

$$\cosh z = \prod_{n=0}^{\infty} \left(1 + \frac{z^2}{(n+\frac{1}{2})^2\pi^2}\right)$$