Particle Physics, Autumn 2006

Assignment 2

1. H&M 4.2

2. H&M 4.3: In addition, plot the distribution using (recommended) Mathematica. See how much the distribution changes when you include masses, and are at low momenta (start with $p_i = 200$ MeV, and keep on going down by a factor of 2 till you find a difference that can be seen on a plot). The latter part may be done numerically, no need of analytic expressions.

X. H&M 4.6: Don't submit, but you'll use it for the following exercises.

3. H&M 4.8: Draw the Mandelstam plot using Mathematica or anything else.

4. Plot $d\sigma/d\Omega$ for $e^-e^- \to e^-e^-$ and $e^+e^- \to e^+e^-$ scattering, where all the particles are taken to be spinless and (nearly) massless. You are encouraged to use Mathematica, and the s-t-u formalism. No need to rederive the matrix elements, we have done that already.

5. With the definitions of $\phi(x)$ given in the class, show that
(a) $[\phi(x), \phi(y)]$ is Lorentz invariant
(b) $[\phi(x), \phi(y)] = 0$ for $x_0 = y_0$