Ph 340 – Problem Set 1 – Spring 1997

1. A particular particle has (in one space dimension) a four-momentum $\underline{p} = (p, E/c) = (80 \text{ GeV/c}, 100 \text{ GeV/c})$.
   (a) Compute the mass of the particle.
   (b) Compute the speed of the particle.
   (c) Compute the frequency and wavenumber of the associated matter wave.
   (d) Compute the phase speed of the associated matter wave.
   (e) Compute the group velocity of a relativistic wave packet with the central wavenumber obtained above.

2. Modify the demonstration file `packet_demo.r` to demonstrate the behavior of the wave packet associated with a relativistic particle with the central wavenumber equal to the wavenumber obtained in part (c) of the above problem. Obtain a plot of the development of such a wave packet.