Physics 6433, Quantum Field Theory
Assignment #6
Due Wednesday, March 6, 2002

February 27, 2002

1. Derive the following form for the Minkowski-space propagation function in the vicinity of the light-cone

$$m^2|(x-x')^2| \ll 1: \quad \Delta_+(x-x') \approx \frac{i}{4\pi^2}\frac{1}{(x-x')^2+i\epsilon}$$
$$= \frac{i}{4\pi^2}P\frac{1}{(x-x')^2} + \frac{1}{4\pi}\delta((x-x')^2),$$

where P stands for the Cauchy principal value.

2. Derive the following asymptotic forms for the Minkowski-space propagation function for large spacelike, and large timelike intervals, respectively,

$$R = [(x-x')^2]^{1/2}, mR \gg 1: \quad \Delta_+(x-x') \approx i\frac{(2m)^{1/2}}{(4\pi R)^{3/2}}e^{-mR},$$
$$T = [-(x-x')^2]^{1/2}, mT \gg 1: \quad \Delta_+(x-x') \approx e^{-i\pi/4}\frac{(2m)^{1/2}}{(4\pi T)^{3/2}}e^{-imT}.$$

Discuss the correspondence between the Euclidean and Minkowskian propagation functions in these limits.