

HOMEWORK 1

Physics 752

Many body problems in solid state physics

Fall, 2002

1. Show that in a Fermi liquid, $Im\Sigma(k_F, \omega) = A(\omega^2 + (\pi T)^2)$, and no cross terms appear. (hint, use the same approach as for the particle-hole bubble)
2. Derive the full expression for the imaginary part of the particle-hole bubble for free fermions for small external momentum and frequency (a) in D=3 and (b) in D=2.
3. Obtain the expression for the particle-particle bubble at small total momentum and small total frequency.
4. a) Suppose $Im\Sigma_{ret} = C * |\omega|$. What is the form of $Re\Sigma$ at small frequencies? b) Same if $Im\Sigma_{ret} = C\omega^2 \log|\omega|$.