



LUDWIG-
MAXIMILIANS-
UNIVERSITÄT
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8th Exercise Sheet Many-Body Physics

Will be discussed in the week of June 17-21.

Exercise 1: Polarization

Evaluate the bare polarization bubble at zero temperature in three dimensions for spin-1/2 particles $(2s + 1) = 2$,

$$\Pi^0(q) = -2 \frac{i}{\hbar} \int \frac{d^4k}{(2\pi)^4} G^0(k) G^0(k+q). \quad (1)$$

Solution: see FW p 158-163.

Exercise 2: Zero sound

Write down the dielectric function for a spin-1/2 Fermi gas interacting with a δ -potential in the RPA approximation. What happened to the plasmon mode of the electron gas for such a short-range interaction in the dynamic limit? The gapless collective excitation that you should find is called zero sound. What is the difference with ordinary sound?