

Please note: Exercises 14 and 15 are mandatory and have to be submitted to the postboxes in the 5th floor of building 46.

Exercise 14.

Consider a one-dimensional gas of electrons ($S = 1/2$) with N particles in $(0, L)$.

- (a) What are the Fermi momentum p_F and Fermi energy ϵ_F ?
- (b) Calculate $\mu = \mu(T, N/L)$ analogously to the lecture.

Exercise 15.

Calculate the particle-number fluctuation Δn_p^2 of an ideal quantum gas (bosons and fermions) in the grand canonical ensemble at temperature T and in momentum state p . Express them via the expectation value $\langle n_p \rangle$. What is the qualitative difference between bosons and fermions?