

Condensed Matter II

Problem set #2

Spring 2023

1 Density of states 1D-3D

- Give the generic expression for the density of states in the 1D, 2D and 3D cases, given the dispersion relation $E(\mathbf{k})$ in a material.
- Consider parabolic ($E_1(k) \propto k^2$) and linear ($E_2(k) \propto k$) dispersion relations, and compute the actual density of states in each of the six cases, assuming that the bands admit a minimum at point $k = 0$.

2 Fermi surface in 2D

We consider a 2D system in which each atom occupies a site on a regular triangular lattice of lattice constant a . The electrons are treated in the free electron framework, and each atom carries two electrons.

- Determine the parameters of the reciprocal lattice.
- Represent the Fermi surface in the reduced zone.