Exercises Condensed Matter Physics (Experimentalphysik 5c), WS16/17

1) **Density of states** (3 Punkte)

Calculate the density of states $g(\varepsilon)$ of a free electron gas with $\varepsilon(k) = \hbar^2 k^2/2m$ starting from the general expression for the density of states as derived in the lecture:

$$g(\varepsilon) = \int\limits_{S(\varepsilon)} \frac{dS}{4\pi^3} \frac{1}{|\nabla_k \varepsilon(k)|}$$

2) **Quasi-2dimensionale metal** (3 Punkte)

Consider a quasi 2-dimensional metal, in which the mean velocity of the electrons in one plane of the crystal is much larger than in the direction perpendicular to this plane.
Specify a dispersion relation $\epsilon(\mathbf{k})$, which would be consistent with this property and sketch the corresponding Fermi surface.

3) **Fermi-Surface** (3 Punkte)

Consider a 2-dimensional metal with a quadratic crystal lattice and two valence electrons per atom.
Sketch the Fermi surface for such a metal (with weak periodic potential)
a) In the extended zone scheme
b) In the reduced zone scheme