Flächen- und Volumendichten

Das ist ein kleiner Anhang aus dem Hyperscript "Semiconductors". Er enthält alles, was man zur Thematik wissen sollte

Basics

- **Changing** from *volume* to ***surface*** **concentrations** might be a bit confusing, especially for mathematicians.
  - If you imagine a distribution of (mathematical) points in space with an average density of n_V, and then ask how large is the density n_S of points on an arbitrary (mathematical) plane stretching through the volume, the answer is $n_S = 0$, because mathematical points are infinitely small and mathematical planes infinitely thin - you never will cut a point with a plane this way.
  - *Our points, however, are atoms* - they are not infinitely small. Our planes are not infinitely thin either, their minimal useful thickness corresponds to the size of an atom, or to a lattice constant.
- So in computing a *surface density of atoms*, you can do two things:
  - **1.** You actually count the atoms lying on the chosen plane of the crystal (making sure you know if you want your density for a *lattice plane* or for *crystallographically equivalent sheets of atoms in a crystal*
  - This is *not* the same: the density of atoms on a **{100}** *atomic layer* of a **fcc** crystal is only **1/2** of that of a **{100}** *lattice plane*; if you don't see it, *make a drawing*!
  - **2.** You just take the atoms contained in a sheet with thickness a. For an area of S cm^2 its volume thus is $A \cdot a$. Since a volume of **1** cm^3 contains n_V particles, a volume of $A \cdot a$ contains $n_V \cdot A \cdot a$ particles; the surface density n_S thus is

$$n_S = \frac{n_V \cdot A \cdot a}{A} = n_V \cdot a$$