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24.10.2003

Übungen zur Festkörpertheorie I — WS03/04

1. Übungsblatt

Crystal Lattices

1. Bravais lattice and Crystal basis

   a) Prove that the two-dimensional (2d) honeycomb lattice is not a Bravais lattice.

   b) Give an example how the 2d honeycomb lattice can be described as a Bravais lattice with basis.

2. Packing density in crystals

   a) Show that the volume of the parallel epiped spanned by the three primitive lattice vectors of a Bravais lattice, $\vec{a}_1$, $\vec{a}_2$, $\vec{a}_3$, is $V = \vec{a}_1 \cdot (\vec{a}_2 \times \vec{a}_3)$.

   b) Why does a primitive cell always contain exactly one lattice point? Conclude that, therefore, all primitive cells of a given Bravais lattice have the same volume.

   c) Calculate the point density (length unit = side length of the cube) for an sc, bcc, and an fcc lattice.

3. Reciprocal lattice

   Prove that the reciprocal lattice of the reciprocal lattice of a Bravais lattice is the original Bravais lattice.