Fachbereich C – Mathematik und Naturwissenschaften
– Physik –

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Theoretical solid state physics, WS 08/09

1st practice sheet

Closing date: 23.10.2008, at 12:00 into the PO Box

1. **Symmetries of unit cells (4 points)**

   Find all symmetry axes and planes of

   (a) the simple cubic lattice,

   (b) the hexagonal Bravais lattice.

2. **Tetragonal face-centered structure and NaCl (2 points)**

   The tetragonal face-centered and the NaCl structure do not appear explicitly in the list of the 14 Bravais lattices. Why? How can you describe these lattices as one of the 14 Bravais lattices (with basis)?

3. **Close-packed spheres (6 points)**

   Consider the model of solid spheres. Calculate the fraction of space the spheres fill up for the following lattices:

   (a) simple cubic (sc),

   (b) body-centered cubic (bcc),

   (c) face-centered cubic (fcc),

   (d) hexagonal close-packed (hcp).

4. **Distance between adjacent lattice planes (6 points)**

   Consider a lattice plane of a skew-angled lattice characterized by the Miller indices (h, k, l). Show that

   (a) the vector $\vec{G}_{hkl}$ of the reciprokal lattice is perpendicular to this plane,

   (b) the distance between adjacent planes is given by $d_{hkl} = 2\pi/|\vec{G}_{hkl}|$.