Physics with Neutrons I

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Exercise sheet 4

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wiki.mlz-garching.de/n-lecture05:index

1. Reciprocal lattice

A 2-dimensional hexagonal lattice is given in the normal space. Determine the reciprocal lattice vectors and draw the lattice in the reciprocal space.

2. Powder diffraction

In a powder diffraction experiment with a material having a cubic unit cell and using a neutron wavelength of $\lambda = 1.5\,\text{Å}$, the first few Bragg peaks occur at the scattering angles $\Theta = 43.31°$, $50.44°$, $74.12°$, $89.93°$. Determine the structure (bcc, fcc, etc.) these peaks correspond to. Based on the information, draw the reciprocal lattice with the allowed and forbidden Bragg peaks in the $(hk0)$ and the (hhl) plane. Draw the same reciprocal lattice planes for a diamond lattice.

3. Diamond lattice

Calculate the structure factor for a diamond lattice (an fcc lattice with a two-atomic basis at $(0, 0, 0)$ and $(a/4, a/4, a/4)$).