
Physics with neutrons 2

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Exercise sheet 1

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EXERCISE 1.1

1. With which part of matter do neutrons and photons interact, respectively? What are the differences between light and neutron scattering?
2. What gives rise to coherent / incoherent scattering? Which information can be extracted from each of them?
3. Recall the most important facts about the lattice sum, the structure factor $|S|^2$ and the form factor $|F|^2$.

EXERCISE 1.2

¹Verify the diffraction patterns of Fig. 1. The atomic positions of NaH and NaD in the fcc unit cell are defined by

$$\begin{aligned}\mathbf{b}_{Na} &= a(0, 0, 0), a(1/2, 1/2, 0), a(1/2, 0, 1/2), a(0, 1/2, 1/2) \\ \mathbf{b}_{H/D} &= a(1/2, 0, 0), a(0, 1/2, 0), a(0, 0, 1/2), a(1/2, 1/2, 1/2)\end{aligned}$$

¹Furrer A. et al., Neutron scattering in condensed matter physics, Singapore: World Scientific, 2009

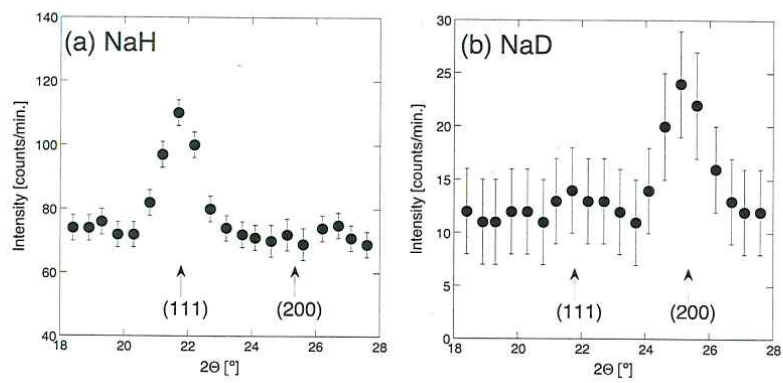


Figure 1: Neutron diffraction patterns obtained for NaH and NaD at room temperature (Shull *et al.*, 1948)