Physics with neutrons 2

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Exercise sheet 1
To be discussed 2017-05-09, room C.3203

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EXERCISE 1.1

Calculate and draw the coherent and incoherent differential scattering cross section from scattering at two nuclei with scattering lengths b_1 and b_2 and a distance of R.
How does the coherent cross section evolve with an increasing number of nuclei with equal distances placed along a line?

EXERCISE 1.2

1. In equation (C.1.12) the scattering field ψ_s is given for a general scattering length density distribution $\rho(r)$. As neutrons scatter from unpaired electrons and therefore an extended potential, show how the magnetic form factor results from the generalised distribution.
2. Calculate the form factor for an unpaired electron in a spherical shell of radius R_0.
3. What is the form factor for an unpaired electron inside a solid sphere of radius R_0?

EXERCISE 1.3

Proof that $\mathbf{G}_{n'}\mathbf{r}_n = 2\pi m$ for all n and n' with $\mathbf{G}_{n'} = n_1\mathbf{g}_1 + n_2\mathbf{g}_2 + n_3\mathbf{g}_3$ given in (C.1.16) and $\mathbf{r}_n = n_1\mathbf{a}_1 + n_2\mathbf{a}_2 + n_3\mathbf{a}_3$ describing the Bravais lattice.