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# Physics with neutrons 2

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Exercise sheet 11

To be discussed 2017-07-25, room C.3203

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## EXERCISE 11.1

Calculate the spin wave dispersion for an fcc lattice with nearest and next-nearest neighbor interactions  $J_1$  and  $J_2$ , respectively. The spin-wave dispersion is given by (Wagner (1972))

$$\hbar\omega(\mathbf{q}) = 2S(J(0) - J(\mathbf{q})) + g\mu_B H_a \quad (1)$$

with the Fourier transformed exchange function

$$J(\mathbf{q}) = \sum_{j,j'} J_{jj'} e^{i\mathbf{q}\cdot(\mathbf{R}_j - \mathbf{R}_{j'})} \quad (2)$$

as e.g. given in ‘Neutron Scattering in Condensed Matter Physics’ by A. Furrer page 145ff (the book also gives a good introduction to magnetic excitations). Knowing the exchange constants of EuO and EuS<sup>1</sup>, discuss their dispersion near the zone boundaries.

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<sup>1</sup>L. Passell et al., Phys. Rev. B 14 (1976) 4897