

Paramagnetic particles experience a force that is proportional to the magnetic field gradient and the induced magnetic moment (**Feynman et al., 1963**; Ch 35; **Pankhurst et al., 2003**). In the experiments of **Wheeler et al. (2016)** the field strength was ~ 0.05 T and the field gradient ~ 6.6 T/m (their Supplementary Figure 2). What is the resulting force on a ferritin particle?

The interaction energy between the moment and the magnetic field is

$$U = -\frac{1}{2} mB, \quad (9)$$

where the factor of $1/2$ arises because the moment m is in turn induced by the field (**Jackson, 1998**; Ch 5.16). The force produced by the field gradient is the spatial derivative of that energy, namely

$$F_1 = -\frac{d}{dx} U = \xi B \frac{dB}{dx} = 2 \times 10^{-22} \times 0.05 \times 7 \text{ N} = 7 \times 10^{-23} \text{ N}. \quad (10)$$

This would be the force exerted by one ferritin complex on its linkage under the reported experimental conditions.