$$\sqrt{\sigma_1} = \left(\frac{\sqrt{\sigma_1} + \sqrt{\sigma_2}}{2}\right) + \left(\frac{\sqrt{\sigma_1} - \sqrt{\sigma_2}}{2}\right)$$

$$\sqrt{\sigma_2} = \left(\frac{\sqrt{\sigma_1} + \sqrt{\sigma_2}}{2}\right) - \left(\frac{\sqrt{\sigma_1} - \sqrt{\sigma_2}}{2}\right) \tag{5-14}$$

The first term is common to both, that is, the scattered amplitude is the same for this term (the so-called "coherent" part). The second term, "incoherent" part, is opposite in sign for the two amplitudes. The coherent part gives rise to interference, whereas the incoherent part gives rise to scattering as if from an unordered assembly of atoms.

How deep will a beam of neutrons penetrate inside a crystal if the Bragg condition is satisfied? Consider a beam of ν neutrons/cm^2/sec incident on a simple cubic crystal, Figure 26. If there were but one atom in the crystal, then the number of neutrons scattered would be $\nu\sigma$ neutrons/sec. This would be isotropic, so that at a distance r from the crystal, the intensity would reduce to $\nu\sigma/(4\pi r^2)$.

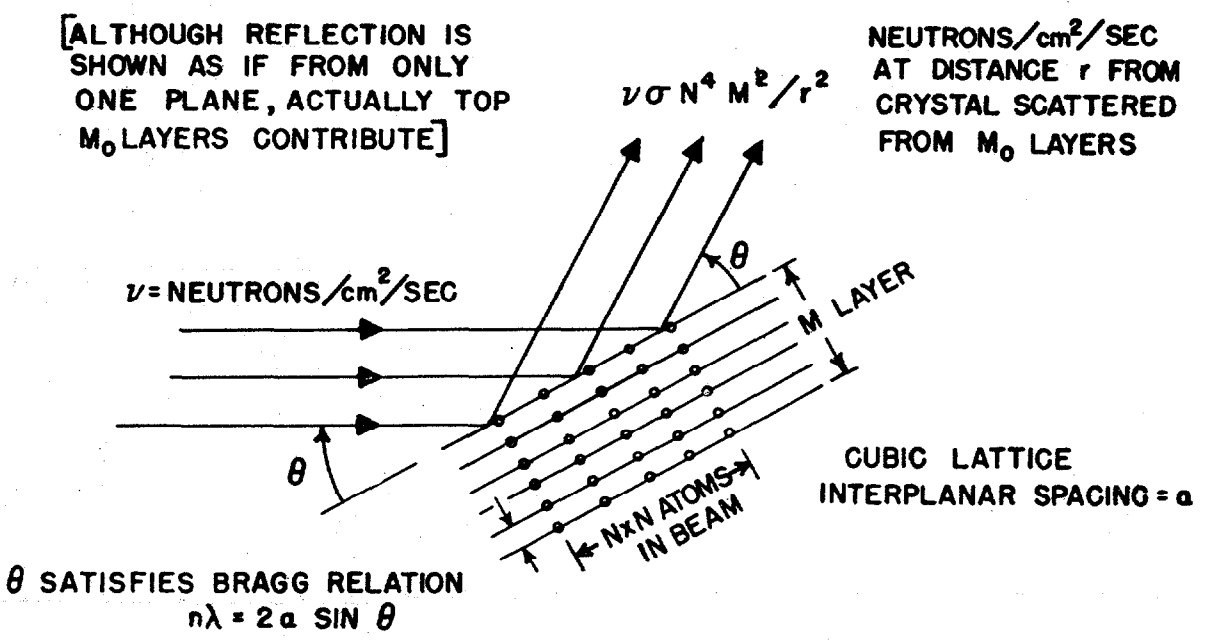

Figure 26. Bragg reflection of neutrons.

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