at x and that $\pi(x)$ is the probability that a neutron from d suffers its first collision at x (either to right or left of d). Now $p(x)$ is the probability that a neutron at x will eventually escape. The probability $p(d)$ that a neutron at d can escape is made up of two terms, the first of which is the probability of escape without collision, and the second is the sum of all possible products of $\pi(x)p(x)$, i.e., probability that the neutron is scattered to x times the probability of escape from x:

$$p(d) = \frac{1}{2}e^{-d/\lambda} + \sum_{all\ x} \pi(x)p(x)$$

It is assumed in the equation that there is isotropic scattering in the lab system, i.e., that $p(x)$ depends only on x and not on the side from which the neutron arrives at x. In detail, the sum should be written:

$$\frac{1}{2}\int_0^d e^{-(x-d)/\lambda}\ \frac{dx}{\lambda}\ p(x)\ \frac{N-1}{N} + \frac{1}{2}\int_d^\infty e^{-(x-d)/\lambda}\ \frac{dx}{\lambda}\ p(x)\frac{N-1}{N} \qquad (7\text{-}14)$$

where the first integral gives the probability that a neutron starting from d will go left, suffer a collision at x, but will eventually escape, and the second integral gives the probability for the same thing with initial motion to the right. N in equation (7-14) is the ratio σ_s / σ_a given in equation (7-13), the average number of scattering collisions made per absorption. The probability that the collision at x is a scattering is $\sigma_s/(\sigma_s+\sigma_a)$ or $N/(N+1) \simeq (N-1)/N$ for $N >> 1$. Simplifying equation (7-14) by combining the integrals and adding the no-collision escape probability gives:

$$p(d) = \frac{1}{2}e^{-d/\lambda} + \frac{1}{2}\int_0^\infty e^{-|x-d|/\lambda}\frac{dx}{\lambda}\,p(x)\ \frac{N-1}{N} \qquad (7\text{-}15)$$

Since the solution of the differential equation gave $p(d) = e^{-d/L}$, we therefore try $p(d)=Ae^{-\alpha d}$ as the solution of this integral equation. Doing this, we find that:

$$p(d) = \frac{\sqrt{N}}{\sqrt{N+1}}e^{-\frac{d}{\lambda\sqrt{N}}} \qquad (7\text{-}16)$$

From equation (7-13) we note that $N = \Lambda / \lambda = 3L^2/\lambda_t\lambda$. Expressing the exponential of equation (7-16) in terms of L gives $\exp(-d\sqrt{\lambda_t}/\lambda/\sqrt{3}L)$, which is to be compared to the exponential $\exp(-d/L)$ derived by the differential equation method.

We are now ready to attack the original problem of finding the albedo. Say a beam of slow neutrons moving along the x axis from the left (negative x) hits the plane $x=0$. The probability that a neutron of the beam will make its first collision in dx at x is $e^{-x/\lambda}(dx/\lambda)$. The probability of not being absorbed and escaping from here is $p(x)\frac{N-1}{N}$. Hence the albedo is:

$$\beta = \int_0^\infty e^{-x/\lambda}\ \frac{dx}{\lambda}\ p(x)\ \frac{N-1}{N} = \frac{\sqrt{N-1}}{\sqrt{N+1}} \qquad (7\text{-}17)$$

A nonabsorbing medium ($N \to \infty$) would eventually return all neutrons and have an albedo of 1.

If we wish to know β for an angle of incident θ we are forced to drop the one-dimensional attack and the problem becomes more difficult. The result is:

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