for $x_1 > x$. We further have

$$V(x) = \frac{1}{\sqrt{\pi}} (2x + 1/mx) I(m^{\frac{1}{2}}x) + e^{-mx^2} / \sqrt{m\pi} \tag{8b}$$

and the integral equation becomes

$$\int_0^\infty S(x,x_1)\, \nu(x_1)\, dx_1 = [\, V(x) + \Gamma \,]\, \nu(x). \tag{9}$$

Although the derivation of the expressions for $\underline{P}$ and V is quite straightforward, it may be worthwhile to give a few of the intermediate steps to facilitate checking the equations.

V(v) is the probability of a collision of the neutron with an atom of unit cross section and the velocity distribution

$$M_m(v_2)\, dv_2 = \frac{4m^{3/2}\beta^3}{\sqrt{\pi}} v_2^2\, e^{-\beta^2 m v_2^2}\, dv_2. \tag{10}$$

The probability for a collision with an atom of velocity v_2 is, if the neutron velocity is v, and the cosine of the angle between the directions of motion is μ, simply

$$v_r = \sqrt{v^2 + v_2^2 - 2vv_2\mu} \tag{10a}$$

which is the relative velocity of the two particles. The number of atoms within unit velocity range at v_2 is given by (10), the probability that μ lies between μ and $\mu + d\mu$ is $\frac{1}{2}d\mu$ so that

$$V(v) = \int_{-1}^{1} \tfrac{1}{2}d\mu \int_0^\infty dv_2\, M_m(v_2) \sqrt{v^2 + v_2^2 - 2vv_2\mu}\ . \tag{10b}$$

The integration over μ is elementary and gives

$$\tfrac{1}{2} \int_0^\infty \frac{M(v_2)}{3vv_2} \left[(v + v_2)^3 - |v - v_2|^3 \right] dv_2. \tag{10c}$$

When integrating this expression one must proceed with the two cases $v_2 < v$ and $v_2 > v$ separately. This kind of disjunction is characteristic also for the calculation of $\underline{P}$. With this proviso, the integration of (10c) can be carried out easily, and it gives (6).

The calculation of $\underline{P}$ is more cumbersome. Collision of a neutron with the velocity v_1 with an atom of velocity v_2 gives a velocity between v and v + dv for the neutron with the probability

$$\begin{aligned} \underline{P}(v;\, v_1,\, v_2,\, \mu) &= 0 && \text{if } v < v_{min} \\ &= \frac{2v}{v_{max}^2 - v_{min}^2} && \text{if } v_{min} < v < v_{max} \\ &= 0 && \text{if } v > v_{max} \end{aligned} \tag{11}$$

These equations express the familiar fact that, after the collision, the probability is uniform in energy scale between the minimum and maximum energies. Herein, μ is again the cosine between the directions of motion of neutron and atom before the collision,

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