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$\tau = \frac{\cancel{N\lambda}}{\cancel{N v}}$ $\qquad \frac{\partial n}{\partial t} + \vec{v}\,\mathrm{grad}\, n$ $\qquad \frac{v}{\lambda} = \cancel{N}\frac{1}{\lambda'}$

$$\frac{v}{\lambda} + \frac{1}{\tau} = \frac{v}{\lambda}\left(1 + \frac{1}{N}\right)$$

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NO. $\frac{\cancel{N}}{\lambda} = \frac{1}{\lambda'}$

G. C. Wick, Sulla diffusione dei neutroni lenti.
(Rend. Lincei 23, 47, 1936)

$$\frac{\partial f}{\partial t} + u\frac{\partial f}{\partial x} + v\frac{\partial f}{\partial y} + w\frac{\partial f}{\partial z} = a - b$$

a：衝突によって (u, v, w) なる範囲へ入るもの
b：出るもの

$\frac{\partial f}{\partial y} = \frac{\partial f}{\partial z} = 0$, $\frac{\partial f}{\partial t} = 0$ とおると

$u^2+v^2+w^2=1$ とおくと f は x と u 丈の函数になる.

$$u\frac{\partial f}{\partial x} = a - b$$

$$b = \frac{1}{\lambda} f(x, u) \qquad \frac{f(x, \xi)\, d\xi}{2\lambda}, \sin d\theta$$

$$a = Q(x, u) + \frac{N-1}{N}\cdot\frac{1}{2\lambda}\int_{-1}^{+1} f(x, \xi)\, d\xi$$

for $x = 0$, $u > 0$: $f(x, u) = 2$ 即ち source は左方にあり,
cos law に従って neutron が入ってくるとする.

albedo $\quad p = \int_0^1 f(0, -u)\, u\, du \Big/ \int_0^1 f(0, u)\, u\, du$

$$q = \int_0^1 f(0, -u)\, du \Big/ \int_0^1 f(0, u)\, du$$

かき直せば

$$\lambda u \frac{\partial f}{\partial x} = \frac{N-1}{2N}\int_{-1}^{+1} f(x, \xi)\, d\xi - f$$

之を $f(x, u) \to 0$ for $x \to \infty$ なる條件の下に解くことになる.

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~~one~~ dimensional に於いて. $u=1,-1$ なるとすると

$$\cancel{\lambda\frac{\partial f_1(x,+1)}{\partial x}}\quad \lambda\frac{df_1}{dx}=\frac{N-1}{2N}(f_1+f_2)-f_1$$

$$-\lambda\frac{df_2}{dx}=\frac{N-1}{2N}(f_1+f_2)-f_2$$

$$f_1=C_1e^{-\mu x}\quad f_2=C_2e^{-\mu x}$$

$$\cancel{\lambda\mu}\quad \left(1-\frac{N-1}{2N}-\lambda\mu\right)C_1=\frac{N-1}{2N}C_2$$

$$+\frac{N-1}{2N}C_1=\left(1-\frac{N-1}{2N}+\lambda\mu\right)C_2$$

$$\cancel{\lambda\mu=1-\frac{N-1}{2N}\pm\frac{N-1}{2N}}$$

$$(\lambda\mu)^2-\left(1-\frac{N-1}{2N}\right)^2=-\left(\frac{N-1}{2N}\right)^2$$

$$(\lambda\mu)^2=1-\frac{2(N-1)}{2N}\;\cancel{+\frac{2(N-1)^2}{4N^2}}=\cancel{\frac{4N^2-4N^2+4N+2N^2-4N+2}{4N^2}}$$

$$\cancel{=\frac{N^2+1}{2N^2}}\qquad =\frac{1}{N}$$

$$\lambda\mu=\frac{+1}{\sqrt{N}}$$

$$\cancel{\lambda\mu=\frac{\pm\sqrt{N^2+1}}{\sqrt{2}\cdot N}}\qquad \cancel{\mu=\frac{+\sqrt{N^2+1}}{\sqrt{2}\lambda N}}$$

$$\cancel{\frac{C_2}{C_1}=\frac{2N}{N-1}\frac{1}{1-\frac{N-1}{2N}-\frac{\sqrt{N^2+1}}{\sqrt{2}N}}}$$

$$\cancel{=\frac{4N^2}{N-1}\frac{1}{2N-N+1-\sqrt{2}\sqrt{N^2+1}}}$$

$$\frac{C_2}{C_1}=\frac{1-\frac{N-1}{2N}-\frac{1}{\sqrt{N}}}{\frac{N-1}{2N}}=\frac{2N-N+1-2\sqrt{N}}{N-1}=\frac{N+1-2\sqrt{N}}{N-1}$$

$$=\frac{(\sqrt{N}-1)^2}{(\sqrt{N}+1)(\sqrt{N}-1)}=\frac{\sqrt{N}-1}{\sqrt{N}+1}.$$

$f_1 = f_2 = f_3 = 2$ for $x = 0$,

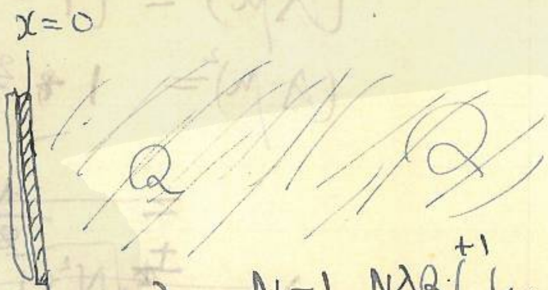
$$\left.\begin{aligned} f_{-1} &= 2 - 1.46_6 \sqrt{3/N} \\ f_{-2} &= 2 - 2.32_4 \sqrt{\frac{3}{N}} \\ f_{-3} &= 2 - 3.12_7 \sqrt{\frac{3}{N}} \end{aligned}\right\} \text{ for } x = 0$$

$$q = \sum_{i=1}^{3} R_i f_{-i} \Big/ \sum_{i=1}^{3} R_i f_i$$

$$q = 1 - \frac{2.00}{\sqrt{N}} + \cdots$$

$$\lambda u \frac{\partial \varphi}{\partial x} = \frac{N-1}{2N} \int_{-1}^{+1} \varphi(x, \zeta)\, d\zeta - \varphi + \lambda Q$$

$\varphi(x, u) = 0$ for $x = 0$, $u > 0$.



$$\varphi(x, u) = N\lambda Q - \frac{N\lambda Q}{2} f(x, u)$$

$$-\frac{N\lambda Q}{2} \cdot \lambda u \frac{\partial f}{\partial x} = \cancel{\frac{N-1}{2N} \int_{-1}^{+1}} \frac{N-1}{N} (N\lambda Q) - \frac{N-1}{2N} \frac{N\lambda Q}{2} \int_{-1}^{+1} f(x\, u)\, du$$

$$- \cancel{N\lambda Q} + \frac{N\lambda Q}{2} f \cancel{+ \lambda Q}$$

$$I_i = \int_{-1}^{+1} \varphi(\infty, u)\, du = 2N\lambda Q.$$

$$I_e = \int_0^1 \varphi(0, -u)\, du = \frac{1-q}{2} I_i$$

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$$-\lambda\alpha u\, g(u) = \frac{N-1}{2N}\int_{-1}^{+1} g(u)\,du - g(u)$$

$$= G\ ?$$

$$(1-\lambda\alpha u)\, g(u) = \frac{N-1}{2N} G$$

$$\int_{-1}^{+1}\frac{du}{(1-\lambda\alpha u)} = \frac{2N}{(N-1)G}\int_{-1}^{+1} g(u)\,du$$

3次元ならば

$$f(x,u) = g(u)e^{-\alpha x}$$

とおくと, boundary condition は満足され,

$$\frac{2N}{N-1} = \int_{-1}^{+1}\frac{du}{1-\alpha\lambda u} = \frac{1}{\lambda\alpha}\log\frac{1+\lambda\alpha}{1-\lambda\alpha} \qquad (\alpha\lambda<1)$$

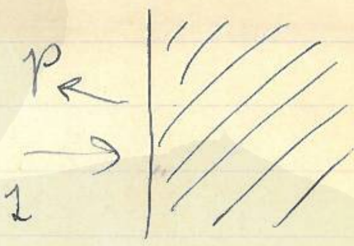
$$\lambda\alpha \pm \frac{(\lambda\alpha)^2}{2} + \frac{(\lambda\alpha)^3}{3} \cdots$$

$$= \lambda\alpha \pm \frac{\lambda\alpha}{2} \pm \frac{(\lambda\alpha)^3}{3}$$

$$2 + \frac{2(\lambda\alpha)^2}{3}$$

$\alpha\lambda \ll 1$ ならば. $\alpha = \frac{1}{\lambda}\sqrt{\frac{3}{N}} + \cdots$

$$1-p = \frac{1}{N\lambda}\int_0^\infty dx \int_{-1}^{+1} f(x,u)\,du$$



$$f(x,u) = 2e^{-\sqrt{\frac{3}{N}}\frac{x}{\lambda}} + ?\cdots$$

$$p = 1 - \frac{4}{\sqrt{3N}} + \cdots ?$$

$$\left(1-p = \frac{1}{N\lambda}\int_0^\infty dx\cdot e^{-\sqrt{\frac{3}{N}}\frac{x}{\lambda}}\cdot G \right.$$

$$\left. = \frac{G}{\sqrt{3N}} \qquad G \cong 2(1+p) \right)$$

$$\int_{-1}^{+1} f(u)\,du = \sum_{i=-n}^{+n} R_i f_i \qquad u_{-i} = -u_i \qquad 0<u_1<u_2<\cdots<u_n<1$$

$$\lambda u_i \frac{df_i}{dx} = \frac{N-1}{2N}\sum_{k=-n}^{+n} R_k f_k - f_i .$$

$P_3(2u-1)=0$ の根を u_1, u_2, u_3 をとる

$$u_1 = \frac{1-\sqrt{\frac{3}{5}}}{2} \quad u_2 = \frac{1}{2} \quad u_3 = \frac{1+\sqrt{\frac{3}{5}}}{2} \qquad R_1 = R_3 = \frac{5}{18} \quad R_2 = \frac{8}{18}$$

$\varphi_{-1} = -1.27\lambda Q\sqrt{N}$

$\varphi_{-2} = 2.01\lambda Q\sqrt{N}$ per $x=0$

$\varphi_{-1} = 2.71\lambda Q\sqrt{N}$

cosine law に従ふならば $\varphi = \mathrm{const.}$

上の distr. は $(\cos\vartheta + \sqrt{3}\cos^2\vartheta)\,d\Omega$ に近い.