α', giving the ratio of "fast" to "slow" neutrons in the "fundamental" is usually small, becoming as great as 35 percent or so only for material free of 28. It turns out that α'' is always negative, showing that the "fast" and "slow" distributions must be "corrected" near the surface in opposite directions.

The most widely applicable boundary conditions are best obtained by considering the neutron reflection coefficients of the surroundings of the reacting material. We represent the resultant reflection coefficient, more conveniently called the "albedo," by γ for the "slow" neutrons, $\epsilon\gamma$ for the "fast." ϵ will be less than unity since "fast" neutrons penetrate farther out into the surroundings and have less chance of returning than the "slow" neutrons.

The boundary conditions may be expressed in terms of the albedo as follows. We represent the density of "slow" neutrons directed outward by n_o, those directed inward by n_i so that

$$n_s = n_o + n_i \tag{5}$$

The net outgoing current will then be

$$\frac{1}{\sqrt{3}} \quad (n_o v_s = n_i v_s)$$

in which the $1/\sqrt{3}$ comes from averaging the directions of the neutrons. According to the diffusion theory the net outgoing current is expressed in terms of the distribution n_s by

$$-\frac{\lambda_s v_s}{3} \frac{dn_s}{dr} = \frac{1}{\sqrt{3}} (n_o v_s - n_i v_s) \tag{6}$$

We now make use of the definition of albedo, γ or $\epsilon\gamma$, as the ratio of incoming to outgoing neutron currents. We shall assume that all "fast" neutrons become "slow" upon reflection. In many cases this assumption is justified and in general it is a safe assumption for our purposes since it tends to make the critical mass smaller. Then

$$\frac{1}{\sqrt{3}} \quad n_i v_s = \gamma \frac{1}{\sqrt{3}} \quad n_o v_s + \epsilon\gamma \left(- \frac{\lambda_f v_f}{3} \frac{dn_f}{dr}\right) \tag{7}$$

since the entire "fast" neutron current

$$-(\lambda_f v_f/3) \quad (dn_f \ (dr))$$

is outgoing. The two equations (5), (6) relating n_o, n_i, and n_s can now be used to eliminate n_i and n_o:

$$n_s + \frac{\lambda_s}{\sqrt{3}} \frac{dn_s}{dr} = \gamma \left(n_s - \frac{\lambda_s}{\sqrt{3}} \frac{dn_s}{dr}\right) - 2\epsilon\gamma \frac{\lambda_f}{\sqrt{3}} \frac{v_f}{v_s} \frac{dn_f}{dr} \tag{8a}$$

This equation is to hold at the surface of the active material (r=R). One sees that for no reflection (γ=0), n_s does not vanish at the boundary but

$$n_s + \frac{\lambda_s}{\sqrt{3}} \frac{dn_s}{dr} = 0 \text{ for } \gamma = 0$$