We now discuss the values one must attribute to the albedos. Most simple to discuss will be not too thick layers of reflecting material surrounding the active mass. If the thickness Δ of the layer is about equal to the mean free path of a neutron in it, then on the average the neutron will suffer one collision and have about a 50% chance of returning to the interior. Thus,

$$\gamma \approx \frac{1}{2} \frac{\Delta}{\lambda} \quad \text{for } \Delta < \lambda$$

Mean free paths for Fe, Ni, Cu and Al are listed in the last table of the second section. One sees that the albedo of Fe will probably be less than a half up to thicknesses of 3 cm or so. One sees that here the "fast" albedo is nearly one half of the "slow" one.

It should be emphasized that as the layer thickness Δ is increased behond the value λ, then the albedo may increase beyond 1/2 but much less than proportionally to Δ.

It may also be important to know what part the walls of a room may plan in neutron reflections. If the wall area S_W is large compared to the surface S_c of the container of the active mass, it is easy to show that the albedo will be given by:

$$\gamma \approx \gamma_c + \frac{(1 - \gamma_c)^2}{(1 - \gamma_W} \frac{S_c}{S_W}$$

in which γ_c and γ_W are albedos of the container and the wall, respectively. For a thick mass like a wall Fermi's well-known albedo formula might be applied:

$$\gamma = 1 - 2/\sqrt{N}$$

where N is the average number of collisions a neutron makes in the wall material before it is captured. A value ~ 100 for N will be of the right order of magnitude for the usual wall materials, giving $\gamma_W = 0.8$. If we now also use the thin layer albedo for γ_c the resultant albedo becomes:

$$\gamma \approx 1/2 \ \Delta/\lambda + 5\left(1 - \frac{\Delta}{\lambda}\right) \frac{S_c}{S_W}$$

Influence of hydrogenous substances.

Neutrons thrown back by a hydrogenous reflector have greatly diminished velocities. An appreciable fraction of the reflected neutrons are thermal. Since the fission cross section in 25 increases with decreasing velocity, neutrons reflected in such a way will give fission with practical certainty and such fission will take place on the surface of the reacting material. The greatly increased fission cross section of the reflected neutrons might lead to the result that in the presence of hydrogenous reflectors the critical amount is greatly reduced.