recently reported in this journal by Sullivan *et al.*[1] The work reported here was done using the extensively neutron irradiated plutonium samples previously described in this journal.[2] Following the irradiation, the plutonium, americium, and curium were separated from each other and from fission products and impurities. The relative amounts of plutonium, americium, and curium were measured and the isotopic compositions of the americium and plutonium were determined using a mass spectrograph. The ratio of the numbers of alpha-disintegrations from the isotopes Am^{242} and Am^{243} was determined by chemical separation with measured yield of the beta-particle emitting daughters Np^{238} and Np^{239} and the measurement of their relative amounts by differential absorption methods using conventional Geiger counters as a means of detection. It was found that the ratio of Am^{243}/Am^{242} was higher by a factor of more than ten than in samples of Am^{241} which had been subjected to comparable neutron irradiations. This result is interpreted to mean that essentially all of the Am^{243} was formed according to the reaction sequence (a) rather than (b).

$$\text{(a)}\quad Pu^{242}(n,\gamma)Pu^{243}\xrightarrow{\beta^-}Am^{243}$$

$$\text{(b)}\quad Am^{241}(n,\gamma)Am^{242}(n,\gamma)Am^{243}.$$

The total amounts of the isotopes Pu^{242} and Am^{243} found in the irradiated plutonium sample allow a calculation of the cross section for the reaction $Pu^{242}(n,\gamma)Pu^{243}$. This cross section was calculated as very roughly 10^2 barns, using an estimated value for the neutron flux. The cross section is subject to a large error due to uncertainty in the estimation of the flux.

Subsequently, samples of plutonium of relatively large Pu^{242} content were produced as indicated in part by the following reactions:

$$Am^{241}(n,\gamma)Am^{242}\xrightarrow{\text{electron capture}}Pu^{242}.$$

Samples of this plutonium were then irradiated with neutrons to produce the isotope Pu^{243}. Following radiochemical purification of the plutonium, O'Kelley and Orth[3] made a rough investigation of the radiations of Pu^{243} using a beta-ray spectrograph and conventional absorption methods. They found the maximum energy of the beta-particles to be 0.39 Mev and gamma-ray energies of 0.095 Mev and 0.12 Mev, thus confirming the beta-particle energy of $\sim$0.5 Mev measured by Sullivan *et al.*[1] The observed half-life of the radioactivity was 5.0 ± 0.2 hours, and the amount of it corresponded roughly with the 10^2-barn cross section estimated above.

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Volkoff's Massive Spheres

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If one writes the static spherically symmetric line element in the form

$$ds^2=-e^{\lambda}dr^2-r^2(d\theta^2+\sin^2\theta d\varphi^2)+e^{\nu}dt^2\ldots \tag{1}$$

where λ and ν are functions of r alone, one gets for a sphere of constant density ρ,

$$e^{-\lambda}=1-x^2+(K/x)\ldots \tag{2}$$

where $x=r/R$, $R^2=3/8\pi\rho$ and K is an integration constant.

While in the usual Schwarzschild interior solution, K is put equal to zero to avoid a singularity at the origin, Volkoff[1] and Wyman[2] have recently considered interesting solutions with $K>0$ and have found that as K increases the radius of a sphere of a given density increases, tending to infinity as K is indefinitely increased. However they have restricted their considerations to the coordinate radius which has no physical significance. If instead, one considers the proper radius r_0 given by $\int_0^{r_b}e^{\lambda/2}dr$, one gets the interesting and rather surprising result that as K increases, the proper radius r_0 decreases monotonically, tending to a finite lower limit as $K\to\infty$. From the point of view of radial length, therefore, these spheres for a given density have definite upper and lower limits to their dimension.

One may, however, also consider the proper volume given by $v_0=4\pi\int_0^{r_b}e^{\lambda/2}r^2dr$ and this quantity is found to tend to infinity as K tends to infinity.

Another point of some interest in the Volkoff-Wyman solution is the influence of the singularity on the field. For weak fields, $\frac{1}{2}\nu'(\equiv\frac{1}{2}d\log g_{44}/dr)$ gives the newtonian gravitational force and, although this approximation breaks down for strong fields, ν' always gives qualitatively some idea about the nature of the "field of force." In the Volkoff-Wyman solution, the condition of fit gives [Eq. (3.13) of Wyman's paper]—

$$m=(4/3)\pi\rho r_b^3-\tfrac{1}{2}KR\equiv M-\tfrac{1}{2}KR \tag{3}$$

and in the outside space $r\geqslant r_b$, $e^{\nu}=1-2(m/r)$, so that

$$\tfrac{1}{2}\nu'=m/r^2=(1/r^2)(M-\tfrac{1}{2}KR).$$

Thus in this region the effect of the singularity is to decrease the attractive field. Near the origin, as $r\to0$, with $K=0$, $\nu'\to0$, and one gets a vanishing gravitational intensity at the center just as in newtonian theory; however, with $K>0$, ν' tends to $+\infty$ as $1/r$. Thus, in the neighborhood of the origin, the singularity introduces an attractive field of force. The presence of an infinite attractive field in this region is also apparent from the infinite negative pressure gradient.

Equation (3) suggests an identification of the singularity with a negative mass particle; in fact, if ρ and K together tend to zero keeping $K/\rho^{\frac{1}{2}}$ constant, the solution degenerates to the Schwarzschild solution for a particle of negative mass at the origin. The foregoing considerations therefore seem to indicate that a negative-mass particle (placed at the center of a sphere of positive density) acts as the source of an attractive field at short distances and a repulsive field at large distances.

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Threshold for Photoneutron Reaction in Th^{232}

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THE mass difference between the $4n+3$ and $4n$ series is accurately known at lead from various experimental measurements.[1] An accurate value for the Th^{232} photoneutron threshold would enable one to check alpha- and beta-decay energies by closed cycle calculations.

The method of detecting the (γ, n) product nucleus used for the U^{238} threshold[2] was applied in a similar manner for determination of the Th^{232} threshold. Samples of thorium nitrate were bombarded in the betatron x-ray beam at six energies in the range 6.7