(2) no negative ions were detected coming from the deactivated wire when it had the same electron emission as the activated wire.

In studies of negative ion formation on pure tungsten surfaces[1] the kinetic theory of reaction rates has been used to interpret the results. According to this theory the ratio of negative ion current to the current of neutral atoms evaporating from the surface is proportional to $e^{(A-\Phi)e/kT}$, where A is the electron affinity of the atom and Φ is the work function of the surface. Hence, much larger halogen negative ion yields would be expected from a thoriated tungsten surface than from a pure tungsten surface at the same temperature. This expectation is in accord with experiments carried out by ourselves and others.[2] According to reference 2, Cl negative ion yields of the order of 0.01 percent are obtained with a pure W surface at very high temperatures. This is to be compared with our value of 60 percent using a thoriated tungsten surface.

The negative ion yields which we find for CsCl, CsBr, and CsI show the trend predicted by the theory, but are in each case much lower than the calculated values. The result for CsF is, of course, completely anomalous.

The theory we have used is considered to be applicable if complete dissociation of the cesium halides occurs on the thoriated W surface and if the accommodation coefficient for the halogen atom is unity. Disagreements between theory and experiment may be interpreted as a failure to satisfy either or both of these assumptions.

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Radioactive Pm^{148} and Pm^{150}

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THE 3.7-year activity of Pm^{147}, the 5.3-day activity of Pm^{148}, and the 2-day activity of Pm^{149} are well established.[1] A 2.7-hour activity without a mass assignment has also been attributed to prometheum,[2] and a 27.5-hour activity has recently been assigned to Pm^{151}.[3] The availability of enriched natural isotopes of neodymium in high purity now provides a method for the further study of the prometheum isotopes.

Oxides of enriched neodymium isotopes were supplied by the AEC.[4] Mass analyses and spectroscopic analyses of these samples were also furnished by the supplier. The enriched samples were bombarded with 6-Mev protons. The decay of the products was followed with a Geiger counter and a Wulf electrometer. The sign of the charge of the beta-particles was determined by magnetic deflection. Bombardment of each of the enriched isotopes in turn for three to seven hours disclosed prominent activities of 2.7 hours, 5.3 days, and 48 days. Longer activities were also produced from some of the neodymium isotopes.

As a result of proton bombardment, an activity with a half-life of 48 days was observed in three neodymium samples containing different isotopic abundances. Chemical separation showed that this 48-day activity belonged with the rare earth group. The 5.3-day activity from the reaction $Nd^{148}(p, n)Pm^{148}$ was also observed in these samples. By the use of the 5.3-day activity, the observed intensities of the 48-day activity in the samples were adjusted for small variations in time of bombardment, sample size, and beam strength. With these adjustments, the intensities of the 48-day activity were 0.74, 5.7, and 125, in samples where the percent abundances of Nd^{148} were 1.4, 5.7, and 89.0, respectively. The intensities of the 48-day activity in the three samples could not be matched with the percent abundances of any other neodymium isotope. These intensities indicate that the 48-day activity was formed by a reaction of protons on Nd^{148}. Since the 2-day Pm^{149} was not observed, a (p, γ) reaction on Nd^{148} is regarded as improbable. The 48-day activity may therefore be assigned to Pm^{148}, formed by the reaction $Nd^{148}(p, n)Pm^{148}$.

The 48-day activity is accompanied by negatively charged beta-particles of 1.7 ± 0.1 and 0.6 ± 0.1 Mev, and gamma-radiation of about 0.54 Mev, as shown by absorption measurements of the radiations in aluminum and lead. The total activity and the activity of each of these components have been followed through three half-lives.

The 2.7-hour activity has been observed previously as a result of bombardment of neodymium with protons and deuterons.[2] In the present investigation, it was produced from three neodymium samples containing different isotopic abundances. The observed intensities of the 2.7-hour activity in the samples were adjusted for variations in sample size, bombardment time, and beam strength by the use of the 5.3-day activity. With these adjustments, the intensities of the 2.7-hour activity in the three samples correspond more closely to the concentrations of Nd^{150} in these samples than to the concentrations of any other neodymium isotope. The adjusted intensities of the 2.7-hour activity were 3.8, 7.4, and 20, in samples where the percent abundances of Nd^{150} were 3.9, 5.6, and 94.8, respectively. It was, therefore, concluded that the 2.7-hour activity was formed by a (p, n) or (p, γ) reaction on Nd^{150}.

The 27.5-hour activity of Pm^{151},[3] which, with protons, would be produced by a (p, γ) reaction, was present, if at all, in very low intensity. This observation would indicate that a (p, γ) reaction with 6-Mev protons on Nd^{150} is not a prominent one. The 2.7-hour activity may, therefore, be assigned to Pm^{150} in accordance with the reaction $Nd^{150}(p, n)Pm^{150}$.

The particle radiation associated with the 2.7-hour activity was negative in sign. The beta-end point was observed at 2.4 ± 0.2 Mev by absorption measurements in aluminum.

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Connection between $\gamma-\gamma$ and Internal Conversion Angular Correlations

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FOR angular correlation purposes one may denote two nuclear transitions in cascade by $J_A(l_1)J_B(l_2)J_C$, where the J's are the total angular momenta of the nuclear levels and the l's are the multipole orders of the successive, pure transitions. (Mixed multipole transitions are not discussed in this note.) For cascades involving γ-quanta and/or conversion electrons, the directional correlation function in terms of the angle, θ, between the propagation directions of the emitted particles may be written,

$$I(\theta)\sim\Sigma_k a_k P_k(\cos\theta), \quad (1)$$

with $k=2, 4, \cdots, 2L$, where L cannot exceed the least of l_1, l_2, and J_B. The a_k are, in general, functions of all the J's and l's; they have been tabulated by Lloyd[1] for $\gamma-\gamma$ cascades, and by the present writer[2] for conversion-conversion cascades, subject to certain approximations specified below. Other papers by Hamilton[3] and Falkoff[4] have tabulated the coefficients of $\cos^{2k}\theta$ rather than $P_k(\cos\theta)$ in the $\gamma-\gamma$ correlations. Recent work by Lloyd,[1] and by Rose *et al.*[5] has established a connection between the a_k for a given $\gamma-\gamma$ cascade and the a_k for the same cascade with one or