pected from the cross section reported by Seren *et al.*[4] A detailed search for the 72-day activity is reported in the succeeding note by Miskel, der Mateosian, and Goldhaber.[5]

Our thanks are due Dr. Keim's group at Oak Ridge who supplied the enriched calcium isotopes.

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[2] M. G. Mayer, Phys. Rev. **78**, 16 (1950).
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The Question of Isomerism in Ti^{51}

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IT was shown in the preceding note[1] that of the two reported cases of isomerism for 29 odd neutrons in even-odd nuclei, *viz.*, Ca^{49} and Ti^{51}, the first case could not be confirmed. In the second case, some doubt was thrown on the existence of the 72-day activity[2] of Ti^{51}, isomeric with 6 min. Ti^{51}. To investigate this activity further we obtained a source of Ti^{51} (72d) of nominally 0.5 millicurie intensity, from Oak Ridge, where it had been produced by slow neutron bombardment of TiO_2.

To find clues for possible chemical impurities in the sample the photon component was studied with the help of physical devices of fairly specific response, which were in use here for other work: a proportional counter for low energy photons[3] and a photoneutron detector for high energy photons.[4] In this way the presence of Hf^{181} (46d) was established with the help of the L radiation accompanying its decay and that of Sb^{124} (60d) with the help of the photo-neutrons which its gamma-rays produce in Be. The spectroscopic analysis accompanying the TiO_2 sample had revealed neither Hf nor Sb. After precipitation of Sb as sulfide, the titanium was purified by repeated distillation of $TiCl_4$ (b.p. 136.4°C) prepared from the irradiated TiO_2. Carriers were added for suspected impurities during the purification. After purification a sample of $\sim$200 mg TiO_2 spread over an area of about 10 cm^2 showed an activity of only 4 counts/min. when measured with a thin end window counter (3 mg/cm^2 of mica). This activity was not studied further. It represented a reduction in intensity from the original activity by a factor of $\sim 10^5$. It is therefore probable that no 72d Ti^{51} exists, and that previous observers were measuring an apparent activity caused by a number of impurities of comparable half-life. In agreement with expectations from the spin orbit coupling model[5] of nuclear shell structure, no case of isomerism for less than 39 odd nucleons is now established for even-odd nuclei.

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† Work carried out under the auspices of the AEC.

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Neutron-Induced Radioactivity in Palladium

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NEUTRON capture in Pd^{110} gives radioactive Pd^{111} which decays by beta-emission with a half-life of 26 min. to Ag^{111}. The 7.5-day activity of Ag^{111} has been studied by several investigators. Helmholz and others[1] found the beta-ray spectrum to be simple with an upper energy limit of 1.06 Mev. Steinberg[2] reports for the beta-rays energy limits of 0.24 Mev and 1.0 Mev. Kraus and Cork[3] report little or no gamma-radiation, and other investigators report no gamma-rays.

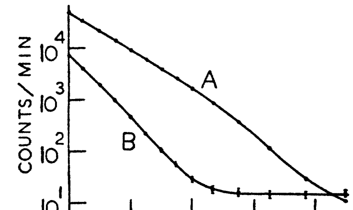

FIG. 1. Absorption of Ag^{111} beta-rays, A, and corresponding beta-gamma-coincidence rate, B.

The neutron-induced radioactivity in palladium has here been investigated with a sensitive scintillation counter. Palladium from Johnson, Matthey & Co., London, of purity 99.995 percent was irradiated in the Harwell pile. The irradiated palladium was dissolved and a small amount of inactive $AgNO_3$ added. The silver was precipitated as the chloride and then redissolved in ammonium hydroxide and reprecipitated.

In addition to the well-known beta-rays, the silver precipitate was found to emit gamma-rays of weak intensity. The activities were followed for six weeks with special attention toward any difference in half-life between the beta- and gamma-activities. The half-lives were found to be equal, both being in agreement with the 7.5 days previously reported for Ag^{111}. An absorption measurement of the gamma-rays gave an absorption coefficient in lead of 0.31 g^{-1} cm^2 which corresponds to an energy of 0.33 Mev. The gamma-rays were found to be in coincidence with the beta-rays. Curve A in Fig. 1 shows the counting rate of the total beta-radiation *versus* thickness of the aluminium absorbers, curve B is the corresponding coincidence rate multiplied by a factor of 100. The upper energy limit of the main beta-spectrum and the upper energy limit of the beta-rays giving rise to coincidences differ roughly by the energy 0.33 Mev of the gamma-rays, though the weak intensity of the gamma-radiation prevents an accurate determination. The intensity of the gamma-rays was found to be 6.5 gamma-rays per 100 beta-particles. No gamma-gamma-coincidences were recorded.

The conclusion is that 6.5 percent of the beta-decay of Ag^{111} has an upper energy limit of 0.73 Mev and leads to an excited state of Cd^{111} at 0.33 Mev. Both this and the 1.06-Mev beta-transition to the ground state appear to be once forbidden. These facts and the conversion coefficients for the transitions[1] in Cd^{111} may be explained by assuming that the 0.33-Mev excited state and the ground state both have the same parity and spin equal to 1/2, while the excited states at 0.247 Mev, 0.396 Mev and 0.420 Mev have spins of 5/2, 13/2 and 9/2 respectively, with parities opposite to that of the ground state.

From the solution the palladium was precipitated with dimethyl-glyoxim. This precipitate showed the 87 kev gamma-rays following the 13-hour activity of Pd^{109} and the very soft components of the 17-day activity of Pd^{103}, but, except for the internal bremsstrahlung no harder component was found in the precipitate.

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The Bohr Formula for the Rydberg Constant

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THE first great triumph of the Bohr theory for the hydrogen atom was the derivation of the Rydberg constant for infinite mass in terms of certain atomic constants. For the past third of a