surface may stop electron emission, but does not noticeably affect the light emission. (c) An ultraviolet lamp shining through the Pyrex envelope onto the Inconel electrode assembly did not excite any photocurrent ($<10^{-14}$ amp). Not more than 1% of the breakdown photons have energies greater than those received from the lamp.

The possibility of thermionic emission is excluded by the observation that there is good agreement between the measurements presented here and others in which the crystal current was pulsed. The electron emission response could be observed for a single 10-μsec pulse of crystal current. Circuit parameters prevented observation of still shorter pulses.

The electron emission of a given sample was found to depend strongly on sample treatment. For example, emission could be suppressed by rinsing the sample in water, then restored by heating the sample to 300°C in air or vacuum. Such effects are not unexpected; surface films and their effects on the work function are obviously important. Heating in air at 800°C for 1 hr also suppressed electron emission, probably because of the formation of an oxide layer[6] of less than 100 A. The emission was again restored by removing the oxide film with HF, followed by heating in air to 300°C. A later report will give more details on surface treatments, including cesium addition.

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NUCLEAR RESONANCE FLUORESCENCE IN Mg^{24}†

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A gamma ray emitted from a nucleus initially at rest has an energy which is less than the energy difference between the levels by an amount equal to the recoil energy of the emitting nucleus. In addition, if the gamma ray is to be resonantly scattered by a nucleus of the same kind, a like amount of recoil energy must be given to the scattering nucleus. Thus the nuclear resonance scattering cross section is extremely small unless this energy deficit is restored.

The 15-hour Na^{24} decays to Mg^{24} by beta emission with an endpoint of 1.39 Mev followed by a gamma cascade with energies of 2.76 Mev and 1.38 Mev. Pollard and Alburger[1] attempted to restore the resonance condition for scattering of the 1.38-Mev gamma ray by making use of the recoil from the previous radiations. No resonant scattering was observed and it was concluded that the 1.38-Mev level had a width of less than 0.01 ev. Recently Burgov and Terekhov[2] successfully used a coincidence method to observe the resonant scattering of those 1.38-Mev gamma rays which have the resonance condition restored by recoil due to the preceding 2.76-Mev gamma ray. The resonance effect was small and a direct cross-section measurement was not possible. However a lower limit (1.6×10^{-4} ev) was placed on the width of the 1.38-Mev level.

A large resonance effect has now been observed and preliminary measurements of the level width have been made. If the emitting nucleus is assumed to be at rest before emission of the gamma cascade, it is not difficult to show that the resonance condition for the second gamma ray can be restored by the recoil of the preceding gamma ray when the angle between the emission direction is given by $\cos\theta = -E_{\gamma 2}/E_{\gamma 1}$. In the particular case of Mg^{24}, $E_{\gamma 1} = 2.76$ Mev, $E_{\gamma 2} = 1.38$ Mev, and it is possible to observe resonant scattering of the 1.38-Mev gamma ray when the angle between it and the 2.76-Mev gamma ray is about 120°.

Pure sodium hydroxide was irradiated for 4-hour periods in the Ford Nuclear Reactor of the University of Michigan. The sources consisted of dilute (1.3 normal) aqueous solutions of NaOH sealed in Lucite containers.

A conventional fast-slow coincidence circuit with an effective resolving time of 15 millimicroseconds was employed in the present measurements. The 2.76-Mev gamma ray was detected by a 5 in. diameter × 4 in. long NaI(Tl) crystal mounted on a DuMont 6364 phototube. A lead collimator was used to restrict the angular width of the gamma ray beam entering this crystal and a pulse-height analyzer was set integrally to accept only the 2.76-Mev gamma ray.

A 1 in. high by 7/16 in. wide rectangular hole was cut between the parallel flat faces of a 2 in. diameter × 2 in. long cylindrical NaI(Tl) crystal. A bar of magnesium metal was placed within this well and the crystal was mounted on an RCA 6342 phototube. The resultant scintillation counter had a pulse height resolution (for direct radiation) of 10% at 1.38 Mev. A lead collimator limited the gamma rays entering this crystal to those which are scattered from the magnesium bar in the center. A differential analyzer was set to accept a narrow range of pulses above the center of the 1.38-Mev photopeak. Thus pulses due to Compton scattering from the magnesium were largely eliminated.

The coincidence rate was observed as a function of angle over a small range of angles centered at 120°. A sharp peak was observed, which, within the limits of experimental error, had an angular width as narrow as that of the collimating system (2.6° as measured by annihilation radiation). The coincidence rate at the peak was consistently two or three times the rate measured at neighboring angles off the peak (depending mainly on the sharpness of the pulse height discrimination).

Since the observed resonance effect was so large, it was possible to perform a self-absorption experiment[3] in order to measure the resonance scattering cross section. The coincidence rate was observed as a function of angle as an aluminum and a magnesium absorber were alternately inserted between the source and the resonance scattering detector. In this way it was possible to calculate the selective attenuation of the resonance radiation by the magnesium absorber. The ratio of the coincidence rates on resonance ($\theta = 120°$) to off resonance ($\theta = 114°$) for a magnesium absorber of 1.96 cm thickness was found to be 1.39 ± 0.26. For an aluminum absorber which attenuated the off-resonance coincidence rate by an amount similar to the magnesium absorber, the ratio of the coincidence rates at 120° and 114° was found to be 2.03 ± 0.3. The level width then follows from the attenuation upon inclusion of the dependence of the resonance effect on the spins involved and the thermal Doppler width. Preliminary data indicate a level width of 7×10^{-4} ev. This corresponds to a mean life of $\tau_\gamma = 0.95 \times 10^{-12}$ sec for the 1.38-Mev level. The statistical uncertainty in these measurements is about 90%. Helm[4] has estimated the mean life of this level from electron scattering data. His value, $\tau_\gamma = 1.9 \times 10^{-12}$ sec, is probably correct to within one order of magnitude and agrees well with the present work.

Experiments are continuing in order to improve the precision of the data and to study the apparent absence of beta recoil effects. A complete report will be published as soon as the measurements are concluded.

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POLARIZED NUCLEONS FROM THE PHOTODISINTEGRATION OF THE DEUTERON

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In a series of previous publications the polarization of the nucleons from the $D(\gamma,n)p$ reaction was calculated.[1,2] It was shown that, for unpolarized γ rays, the polarization $P(\theta)$ is rather sensitive to the final state interactions. The most important transitions are, in order of importance, $E1({}^3S_1 + {}^3D_1 \rightarrow {}^3P_{0,1,2} + {}^3F_2)$, $M1$ spin flip (${}^3S_1 \rightarrow {}^1S_0$ and ${}^3D_1 \rightarrow {}^1D_2$), and $E2({}^3S_1 + {}^3D_1 \rightarrow {}^3S_1 + {}^3D_{1,2,3} + {}^3G_3)$. The $E1$ transition amplitudes are rather well known from the analysis of the angular distribution and total cross section.[3,4] The forthcoming experiments on $P(\theta)$ should provide most important information on the relatively less known $M1$-transition amplitudes. The lack of symmetry of $P(\theta)$ about 90° provides addi-