angular momentum (quantum number J'') of the final state of the system, so that $J=J''+J_2$. In the simplest case, when $J_2=1$, one finds, from (2b) and (4), using the expression for the $\Phi_m(\theta)$'s which can be obtained from Falkoff and Uhlenbeck's paper,[1]

$$\left.\begin{aligned} W(\theta)&\sim 1-\tfrac{1}{3}\cos^2\theta \quad \text{if} \quad \lambda_1=0,\\ W(\theta)&\sim 1-[(J''-2)/(3J''+2)]\cos^2\theta \quad \text{if} \quad \lambda_1=1.\end{aligned}\right\} \tag{5}$$

The two Eqs. (5) become identical for $J''\to\infty$, i.e., for $J\to\infty$.

The actual computation of the asymptotic form of correlation functions from Eqs. (2b) and (4) is, of course, much simpler than the computation of these functions for finite values of J_1. From the practical point of view, this is not, however, of much help because the asymptotic form is being approached, in general, rather slowly as J_1 increases.

[1] D. L. Falkoff and G. E. Uhlenbeck, Phys. Rev. 79, 323 (1950); D. S. Ling, Jr., and D. L. Falkoff, Phys. Rev. 76, 1639 (1949).
[2] The assumption that only one particle is emitted in each transition is not essential and has been made solely to simplify the language. The proposition holds as well for the case when more than one particle is emitted in each transition if the direction of emission of only one particle is observed in each transition (e.g., the case of beta-gamma angular correlation).
[3] B. L. Van der Waerden, *Die gruppentheoretische Methode in der Quantenmechanik* (Springer, Berlin, 1931), p. 69, Eq. (18.2).

The Decay of Neutrons into Neutral Hydrogen Atoms

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(Received September 10, 1951)

THE possibility of radioactive decay by "bound electron creation," i.e., decay such that the electron emitted from the nucleus falls into one of the bound states of the product atom instead of being emitted into the continuum of free states, has been discussed by Daudel, Benoist, Jacques, Jean, and Lecoin.[1-3] Such a process can only have an appreciable probability if the creation can take place in the K-shell, where the value of the wave function of the electron at the boundary of the nucleus is appreciably large. In general, the K-shell of the product nucleus would be already full—and then K-creation would be impossible. The case of the radioactive decay of tritium into He^3, however, is an exception, since two electrons are required to complete the K-shell in helium. Sherk[4] has calculated the ratio of the probabilities of K-creation to the normal disintegration to be 0.0065 for atomic tritium and 0.0035 for molecular tritium.

The purpose of this note is to point out that the possibility of K-creation also exists in the case of the decay of the neutron, as the electron can clearly fall into one of the K-states of the hydrogen atom; i.e., there should be a finite probability that a neutron should decay directly into a neutral hydrogen atom. Using the general formula quoted by Sherk[4], it is easy to calculate the ratio of the probabilities of K-creation to the normal β-decay for the neutron. Assuming the energy of disintegration to be 760 kev, one obtains the value 6×10^{-6} for this ratio. This ratio is much smaller than the corresponding ratio for tritium, since the ratio is proportional to $E_\beta^{-\frac{1}{2}}$ where E_β is the maximum energy of the β-spectrum.

The process of the decay of the neutron into a neutral hydrogen atom also provides an interesting example of recoil of the product nucleus after β-decay, on the neutrino hypothesis. In the case of K-electron creation, as in the inverse process of K-capture, the neutrino must carry off a unique energy almost equal to the energy of disintegration, and thus the product atom must recoil with a unique momentum, equal and opposite to the momentum of the neutrino. In the case of the decay of the neutron by K-creation, one may therefore calculate the unique energy of recoil of the neutral hydrogen atoms from the known energy of disintegration and one obtains a recoil energy of 283 ev. For the decay of atomic tritium by K-creation the recoil energy of the He^3 neutral atom would be about 0.05 ev and for molecular tritium the recoil energy of the resultant hydrogen-helium complex would be half this value (assuming the maximum energy of the β-spectrum of tritium to be about 17 kev).

[1] Daudel, Benoist, Jacques, and Jean, Compt. rend. 224, 1427 (1947).
[2] Daudel, Jean, and Lecoin, Compt. rend. 225, 290 (1947).
[3] Daudel, Jean, and Lecoin, J. phys. radium 8, 238 (1947).
[4] R. M. Sherk, Phys. Rev. 75, 789 (1949).

The Dissociation of Ethyl-Acetate in a Geiger-Müller Counter

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(Received September 4, 1951)

IN an earlier paper,[1] it was shown that when a Geiger-Müller counter was filled with ethyl-acetate and argon and run till it no longer acted as a self-quenching counter, a mass spectroscopic analysis of the contents showed a large increase in mass 44 and a decrease in masses characteristic of the cracking pattern of ethyl-acetate. At the time it was stated that mass 44 was CO_2, a dissociation fragment of ethyl-acetate, and this increase in CO_2 and decrease of ethyl-acetate was in agreement with the Korff-Present theory.

Despite the excellent agreement described there remained the possibility that the CO_2 was in reality being driven out of the walls of the counter by the heat of the discharge in the tube and the ethyl-acetate was being absorbed into the metal portions. To determine which concept was correct the following experiment has been performed.

A counter, similar to the one used in the earlier experiments, was filled with just argon. The counter was run as a non-selfquenching counter for at least 10^{10} counts. The contents of the counter were then studied with the mass spectrometer. The only peak present was mass 40 for argon. No detectable CO_2 peak was observed.

It is now believed that this evidence establishes that the mass 44 increase observed earlier was definitely a dissociation product of the ethyl-acetate.

We wish to acknowledge the assistance of the AEC and the Research Corporation for their support of this work.

[1] S. S. Friedland, Phys. Rev. 74, 898 (1948).

The Sea-Level Latitude Variation of Fast Cosmic-Ray Neutrons

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(Received August 24, 1951)

USING BF_3 proportional counters, containing boron enriched in B^{10}, imbedded in a paraffin block $15\times15\times17$ inches as a moderator of fast neutrons, the intensity of such neutrons generated in the atmosphere by cosmic rays has been measured in India as a function of latitude. The arrangement of the apparatus used will be given elsewhere.[1] The observation stations were chosen within the narrow range of longitudes 78°E to 81°E, extending from near the geomagnetic equator to about 20°N geomagnetic latitude.

In Table I are given the geomagnetic latitude, barometric pressure, and neutron counts per minute for each of the three stations, Aligarh, Nagpur, and Madras. The barometric pressure

Table I. Latitude variation of fast neutrons.

Observation station	Geomagnetic latitude	Barometric pressure (inches)	Neutron counts per minute
Aligarh	18°12′	29.27	2.08±0.03
Nagpur	11° 9′	29.07	1.49±0.02
Madras	3° 4′	30.13	1.57±0.04