and

$$C(D,\lambda)=C(D)+\tfrac{1}{2}e^{\alpha^2/4}\{e^{\alpha x_1}[1-\Phi(x_1+\tfrac{1}{2}\alpha)] - e^{-\alpha x_2}[1+\Phi(x_2-\tfrac{1}{2}\alpha)]\}, \quad (4)$$

where

$$x_1\equiv(\tau-D)/2\langle\Delta t\rangle_{Av}, \quad x_2\equiv(\tau+D)/2\langle\Delta t\rangle_{Av}, \quad \alpha\equiv 2\lambda\langle\Delta t\rangle_{Av}.$$

Equation (4) also approaches a pure exponential decrease for large $D$.

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## On the Half-Life of $Na^{22}$

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August 8, 1949

THE radioactivity of $Na^{22}$, first discovered by Frisch,[1] has been described by the present writer[2,3] as producible by the deuteron bombardment of magnesium and the half-life estimated as 3.0 years.[3] More recently, Saha[4] has given a value of 2.8 years for the half-life of this activity. During the past three years the decay of a $Na^{22}$ sample has been followed in this laboratory and it is the purpose of the present note to report the value obtained for the half-life.

The $Na^{22}$ sample used was produced in 1937 by the bombardment of magnesium metal with deuterons produced by the cyclotron in Professor Lawrence's laboratory at Berkeley. The magnesium target was subsequently mounted in the recess of a brass plate, covered with a mica sheet hermetically sealed to the brass, and, by means of a Lauritsen electroscope,[5] its activity was compared at intervals with that from a standard uranium oxide source

The resultant decay curves, for two different source positions, are shown in Fig. 1 and indicate a half-life of 948 days or 2.6[0] years.[6] It should be mentioned that diffusion of the active material from the surface into the magnesium metal would, if appreciable, result in an underestimation of the half-life, since the greater portion of the activity measured was readily absorbable (positrons). Some confirmation of the belief that diffusion and similar processes played no significant role in the present work is afforded, however, by the observation that absorption curves taken at the beginning and end of the measurements (curves 1 and 2 of the insert, Fig. 1) appeared entirely similar and were in agreement with one obtained[3] shortly after the sample was first prepared.

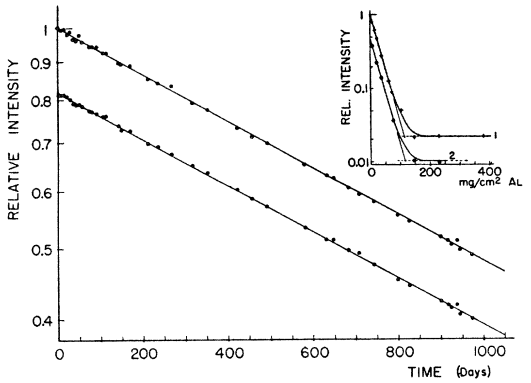


FIG. 1. Logarithmic decay curves of $Na^{22}$ activity, measured with respect to that of an uranium oxide standard, for two source positions. *Insert*: Aluminum absorption curves (logarithmic scale of ordinates) taken (1) at the beginning and (2) after completion of the decay measurements.

It is a pleasure for the writer to indicate once again his gratitude to Professor Lawrence for the privilege of using the cyclotron in connection with the preparation of the sample used in the work reported here.

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[5] The electroscope, manufactured by the F. C. Henson Company (Pasadena), was used to measure the ionization in a chamber approximately 2¼ inches in diameter and 3 inches long, into which the radiation passed through an aluminum window of 1.2 mg/cm² surface density. The surface density of the mica covering the source was 5.2 mg/cm². We are indebted to Dr. A. F. Voigt for making available to us this electroscope in its modified form.
[6] A value of 2.6 years was provisionally communicated to Dr. G. T. Seaborg during the course of this work and has subsequently appeared in the review article of Seaborg and Perlman (Rev. Mod. Phys. **20**, 585 (1948)).

## Microwave Spectrum of $CF_3Cl$

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THE $CF_3Cl$ rotational transitions between $J=2$ and 3 and between $J=3$ and 4 have been observed in the microwave regions around 20 kmc and 27 kmc. Thirty-one lines were measured, including five lines which are attributed to molecules in an excited vibrational state. The hyperfine structure spacing yields quadrupole coupling constants of 78.05±0.2 and 61.44±0.4 mc for $CF_3Cl^{35}$ and $CF_3Cl^{37}$, respectively.

At a pressure of 0.1 mm, the line widths were approximately 5 mc, corresponding to a molecular collision cross section of 1400A².

The values of $B_0$ for $CF_3Cl^{35}$ and $CF_3Cl^{37}$ were found to be 3335.56 and 3251.51 mc, respectively. From these values one may calculate that the distance of the Cl nucleus from the center of mass of the $CF_3$ group is 2.129A, and that the moment of inertia of the $CF_3$ group about an axis through its center of mass and perpendicular to the symmetry axis is 46.31 mass units times angstroms².

If one assumes tetrahedral angles, one then obtains for the internuclear distance C—F=1.323A and C—Cl=1.765A. These are quite consistent with electron diffraction values on similar fluorochloromethanes.

## Hyperfine Structure of Fe 57*

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August 1, 1949

A SEARCH for the hyperfine structure of Fe 57 was carried out by means of a Fabry-Perot interferometer, crossed with a 35-foot concave grating in the Wadsworth stigmatic mounting (the blaze being in the second order).

The wave-length scale covered extended between 6000A and 2400A. No structure, broadening, or asymmetry was found. The resolution obtained would have revealed any over-all structure greater than $25\cdot10^{-3}$ cm$^{-1}$ between 6000 and 4000A and $50\cdot10^{-3}$ cm$^{-1}$ near 2500A. The discharge tube was a hollow cathode cooled with liquid nitrogen, the carrier being argon with a trace of helium. The spectrum was very extensive and was readily photographed. At least 400 lines were examined. Among others, the following electron configuration of Fe I were involved: $3d^74s$, $3d^64s4p$, $3d^64s4d$ and $3d^64s5s$, $3d^64s^2$, $3d^74p$. It was not found possible to excite Fe II by changing widely the conditions of the discharge.