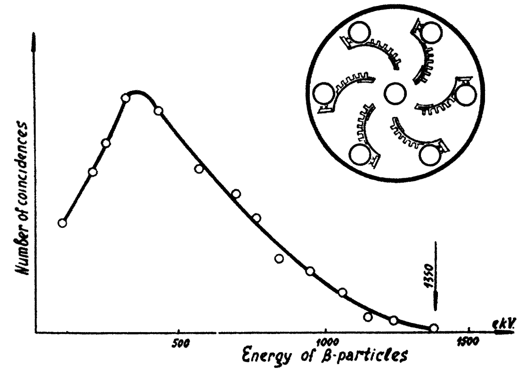

FIG. 1. Above—magnetic spectrometer with 7 counters. Below—β-ray spectrum of K^{40}.

pose RaE was mixed in the required proportions with $CaCO_3$ (60 mg/cm^2). The comparison of β-spectrum of RaE as found by us with those obtained by Neary and Alichanow, Alichanian, and Dželepow[5] showed that the distortions existed only in the region lower than 400 kev, and reached 60 percent at 100 kev. The suitable corrections having been made, the β-spectrum K^{40} (shown in Fig. 1) was obtained. The spectrum upper limit is 1350 ± 50 kev. As to its shape the β-spectrum K^{40} is similar to a spectrum belonging to the allowed transmutations.

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The Inversion Spectrum of Ammonia

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THE strong absorption band[1] of NH_3 at 0.8 cm^{-1} has been resolved into 28 sharp, widely separated lines. The necessary high resolution was obtained by using a continuous wave source. The gas sample is held in a section of waveguide two and one-half meters long, which is arranged in a balanced system with two crystal detectors.

At a pressure of about 0.1 mm Hg it is possible to observe each fine structure line (see Fig. 1) on an oscilloscope by synchronizing the horizontal sweep of the oscilloscope with the frequency sweep of the oscillator tube. Identification of the lines was accomplished by using a calibrated absorption type wavemeter.

Preliminary measurements of the frequencies and the intensities of the various lines are graphed in Fig. 2. Every line is completely resolved. In fact, the half-widths of the lines at this pressure are less than the width of the inked lines on the graph.

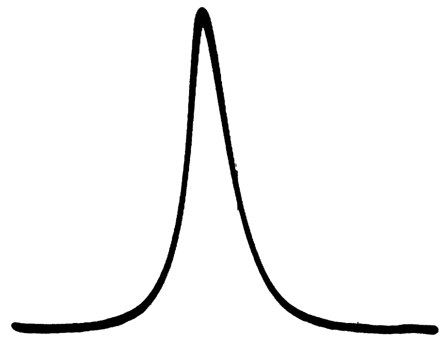

FIG. 1. One of the absorption lines for NH_3. $f = 23{,}878$ mc/sec.; $p \simeq 0.1$ mm Hg; Intensity$\simeq$0.18 db/m; full scale frequency sweep $=22$ mc/sec. $=0.00073$ cm^{-1}.

Each line can be associated with the molecule being in a definite rotational state. The centrifugal distortion caused by being in a particular rotational state slightly affects the inversion frequency.

The theoretical expression that Hsi-Yin Sheng, E. F. Barker, and D. M. Dennison[2] derive for this case is

$$\frac{\nu}{hc}\,(\mathrm{cm}^{-1}) = \frac{\nu_0}{hc} - 0.0011(J^2 + J - K^2) + 0.0005K^2,$$

however, their infra-observations gave -0.00_5 for the coefficient of $(J^2 + J - K^2)$. The preliminary expression that we obtain from our experimental data is

$$\frac{\nu}{hc}\,(\mathrm{cm}^{-1}) = 0.7932 - 0.0048(J^2 + J - K^2) + 0.0020K^2.$$

The observed intensity of the lines agrees well with the population of the various rotational levels for thermal equilibrium at 300°K.

As the pressure of the NH_3 is reduced, the lines are observed to become sharper and at a pressure of about 10^{-2} mm Hg a hyperfine structure is resolved. The investigation is being continued using improved equipment.

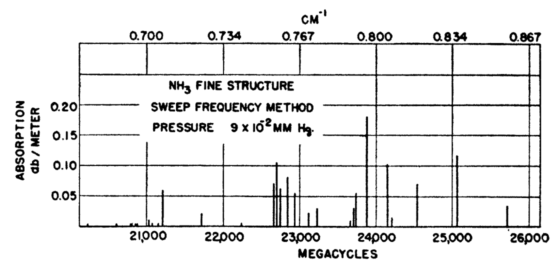

FIG. 2. The inversion spectrum of ammonia. $T = 24°C$.

Addendum: After preparation of this letter we received the March 16, 1946 issue of Nature in which we note the excellent work of Bleaney and Penrose on this same subject.

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