Our recomputation yields the following values[5]

$$\begin{array}{ll}\textit{First Excited States} & -0.156(J^2+J)+0.219K^2,\\ \textit{Normal States} & -0.0035(J^2+J)+0.0053K^2.\end{array}$$

The agreement between theory and experiment for the excited states is still good; but for the ground states, where the experimental data are the best, it is only fair.

We have reexamined the theory and have attempted certain variations. (a) the Manning double minimum potential was replaced by a parabolic double minimum[6] but no substantial change was found. (b) The paths of the hydrogen particles throughout the motion were originally determined through the potential constants of the molecule. These are not known with too great accuracy and some variation in path could be used. Unfortunately, a change that helps the agreement for the normal states, tends to produce disagreement for the excited states. As an example we took a path where $(dr/d\alpha)_{\alpha=\alpha_0}=0.20$. (The value used by S., B., and D. was 0.10.) We find,

$$\begin{array}{ll}\textit{First Excited States} & -0.21(J^2+J)+0.24K^2,\\ \textit{Normal States} & -0.0047(J^2+J)+0.0059K^2.\end{array}$$

On the whole these results are moderately satisfactory. It appears to us that the remaining discrepancies may be attributed in part to the approximate character of the theory and in part to a lack of knowledge of the details of the molecular forces in ammonia.

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[1] B. Bleaney and R. P. Penrose, Nature **157**, 339 (1946).
[2] C. H. Townes, Phys. Rev. **70**, 109(A) (1946).
[3] W. E. Good, Phys. Rev. **70**, 213 (1946).
[4] H. Sheng, E. F. Barker and D. M. Dennison, Phys. Rev. **60**, 786 (1941).
[5] In a private communication Dr. Townes informed us that he also has recalculated certain of the splittings. His results appear to be in substantial agreement with ours.
[6] D. M. Dennison and G. E. Uhlenbeck, Phys. Rev. **41**, 313 (1932).

Solar Ultraviolet Spectrum to 88 Kilometers

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THE ultraviolet spectrum of the sun below 3400A was photographed to altitudes up to 88 km by means of a spectrograph mounted in the tail fin of a V-2 rocket. The rocket was fired on October 10, 1946 by Army Ordnance at the White Sands Proving Grounds, New Mexico, and reached an altitude in excess of 160 km. A series of 35 spectra was obtained during the ascent. Solar spectra above 88 km were not photographed because the rocket turned the spectrograph away from the sun, and excessively rapid use of film produced by severe vibration earlier in the ascent prevented operation above 107 km.

The spectrograph was designed for the nose of the rocket and utilized an f:10, 40 cm radius, 15,000 line/inch grating in a Rowland mount. The grating was ruled on aluminum at the Johns Hopkins University. The film was Eastman 35-mm 103–0 ultraviolet sensitized, and was 20 feet long. As many as 100 exposures could be taken. An eight-second exposure cycle with separate exposures of 0.12, 0.66, and 3.6 seconds was provided. In place of a slit a 2-mm diameter sphere of lithium fluoride was used. This formed a small real image of the sun which acted as source and because of the astigmatism introduced by the grating produced a line spectrum. This system accepted sunlight over a wide field of view and was many times faster than a conventional slit of equivalent width covered with a diffusing plate. A second bead was placed diametrically opposite the first to provide a second channel, thereby doubling the chance of receiving sunlight as the rocket turned. A plane mirror on each side folded the two light paths to fit the conical nose. The dispersion was 44A/mm and the resolution about 3A. The spectrograph was evacuated by a port open to the atmosphere. The short wavelength limit of the spectrograph was set by the transmission limit of the lithium fluoride bead, and spectra to wavelengths as short as 1100A were produced in the laboratory.

Sample spectra are reproduced in Fig. 1. All exposures shown were 3.6 seconds and altitudes given are above sea level. Up to about 44 km the rocket was stabilized. Above this point it rolled and yawed and spectra F and G were taken with the sun well off axis. Consequently G, the highest solar spectrum taken to date, was so lightly exposed that it showed less ultraviolet than F. The spectra were shaded in printing to emphasize as much as possible the region of interest. Definition in E and F was reduced by vibration and by rotation of the rocket. It was a

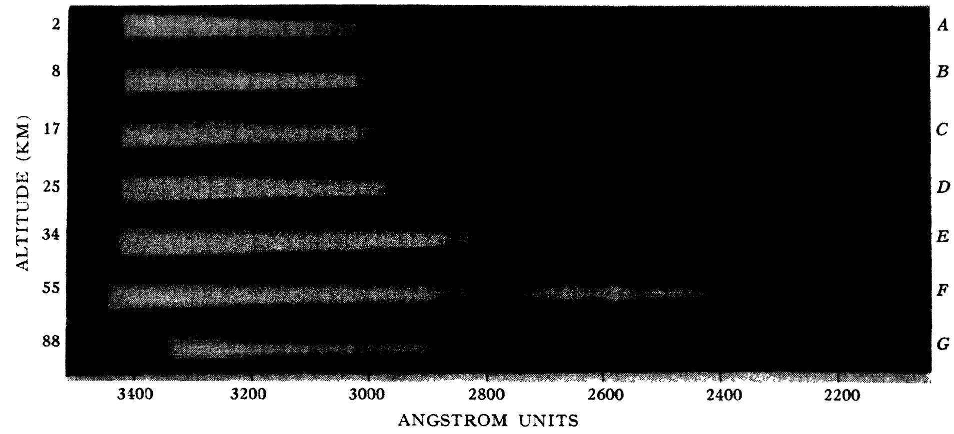

FIG. 1. Solar spectrum at various altitudes.

characteristic of the bead slit system that the spectra moved slightly, mainly along the lines, as the rocket rolled. The effect appears in spectra *F* and *G* which show the spectrum displaced somewhat along the lines during exposure.

Preliminary examination of the spectra showed a progressive extension of the spectrum into the ultraviolet. At 25 km the spectrum was photographed to 2925A. Spectrum *E* taken at 34 km extended to 2650A and showed measurable blackening from approximately 2100 to 2260A which may be lost in reproduction. At 24 km therefore there was still enough ozone above to prevent recording the spectrum in the central region of the Hartley band of ozone, but transmission in the window between the Hartley band and the oxygen absorption at shorter wavelengths was observed. At 55 km sufficient ozone was passed through to permit photographing the spectrum throughout the Hartley band.

An analysis of the absorption features of the spectrum and a determination of the solar spectra intensity curve of the sun and of the details of the ozone distribution in the atmosphere are in progress.

Disintegration of $_{17}Cl^{34}$

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October 2, 1946

THE β^+-spectrum of $_{17}Cl^{34}$ has been already studied by Sagane[1] by means of a Wilson chamber and its maximum energy has been estimated to be 3 Mev. On the other hand, Brandt,[2] using the absorption method, has obtained a value of 2.5 Mev. Neither author indicated any presence of γ-rays from the disintegration of $_{17}Cl^{34}$.

In order to obtain more accurate data on the energy and disintegration process of $_{17}Cl^{34}$, I have undertaken the experiment with a Wilson chamber of longer effective time. The source of $_{17}Cl^{34}$ which is relatively thin is prepared by the bombardment of CuS by fast deuterons, according to the reaction

$$_{16}S^{33}(d,n)_{17}Cl^{34}.$$

As S^{33} is a rare sulphur isotope (only 0.74 percent), the activity of Cl^{34} is relatively weak. The active chlorine is precipitated in the form of AgCl; purification and precipitation are repeated, until the source shows no other activity than that of 33-minute period from $_{17}Cl^{34}$.

The experimental conditions are as follows: The cloud chamber is filled with air at an initial pressure of 1.9 atmos., the magnetic field being 900 gauss. The source is placed outside the chamber. After traversing a mica window of 12 mm diameter, (3.94 mg/cm^2), the trajectories of the positrons are photographed stereoscopically.

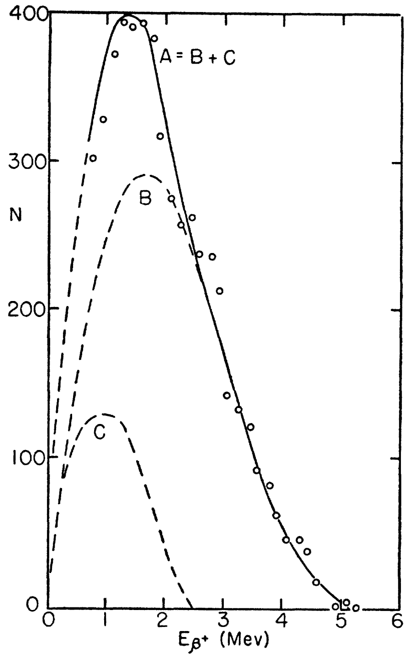

FIG. 1. Energy distribution of the positrons from Cl^{34}.

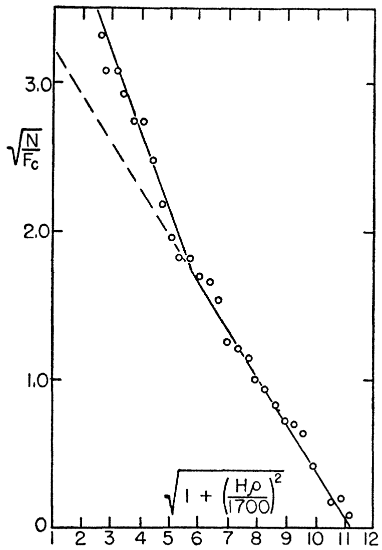

FIG. 2. Van der Held plot of the positron spectrum from Cl^{34}. The abscissa represents the energy, including the rest energy, of the positron in units of the rest energy of an electron.

In total, 2088 positron tracks with $H\rho > 3500$ gauss-cm ($E_\beta > 680$ kev) have been measured. Their energy distribution is shown in Fig. 1, curve *A*. The maximum energy of β^+-spectrum is estimated to be 5.1 ± 0.3 Mev. In order to know whether the spectrum is simple or complex, analysis has been carried out according to Van der Held's method[3] which is a combination of the Fermi's and Konopinski-

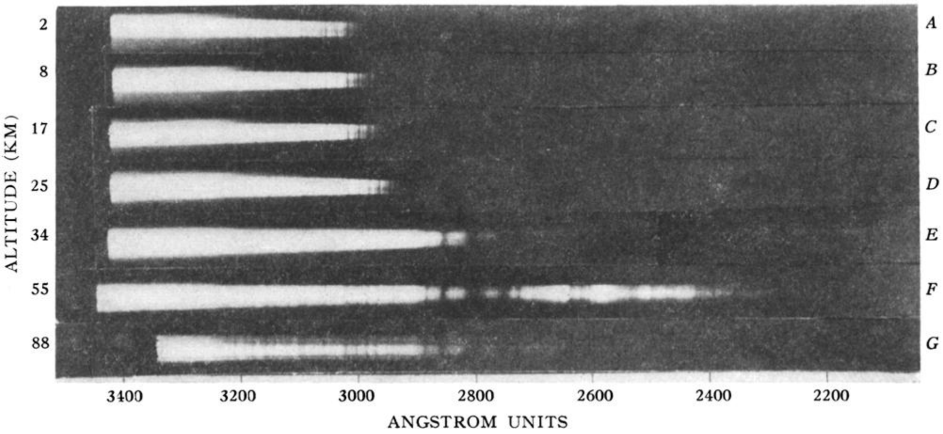

FIG. 1. Solar spectrum at various altitudes.