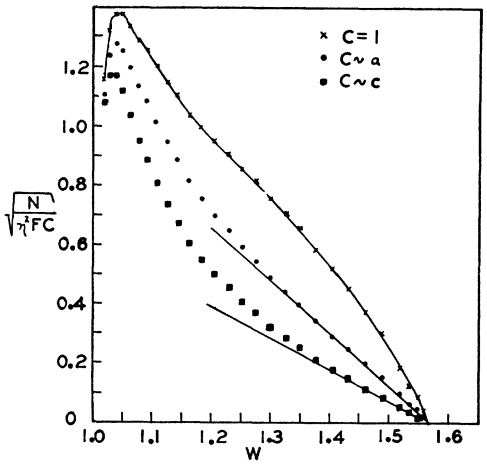

FIG. 1. Fermi plots for Tc^{99}.

deposits of thicknesses 0.17 and 0.05 mg/cm². Taking account of the large errors inherent in this type of determination, the results of this work showed that for the thinnest Tc^{99} source used, distortion due to source thickness should probably be negligible at energies greater than 125 to 150 kev.

Fermi plots of the thin source data are shown in Fig. 1. The end-point energy was determined to be 0.292±0.003 Mev from runs on four different sources. Using this value and the half-life quoted above, an *ft* value of 2.3×10^{12} is obtained. Empirically, this figure would make the transition at least second-forbidden. In addition, the nuclear shell model[6] predicts a probable spin change of 3 units and no parity change, thus classifying the transition as second-forbidden under the G-T selection rules. In such a case, the correction factor $c\sim3p^4+10p^2q^2+3q^4$ should apply. Examination of Fig. 1 shows that this factor yields a straight line plot down to approximately 200 kev. The results obtained with the other second-forbidden correction factors having a definite energy dependence were in all cases worse. (No attempt was made to apply the correction factors containing a combination of matrix elements.) Application of the correction factor $a\sim p^2+q^2$ produced a fairly good straight line down to approximately 140 kev. As noted above, this is the region in which distortion due to source thickness might be expected for a source of the thickness used. It seems plausible to conclude, then, that the correction factor *a* applies, and that the transition is probably first-forbidden, $\Delta J=\pm2$ (yes), under the G-T selection rules. This conclusion leaves the large *ft* value unexplained. Because of the source thickness used, however, these results should be verified with a thinner source when higher specific activity material becomes available.

I would like to thank Drs. C. M. Van Atta and S. D. Warshaw for their advice and encouragement during the course of this work.

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The Absence of Atmospheric Ethylene*

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SUTHERLAND and Callendar[1] have suggested resemblances between the atmospheric spectrum taken by Adel[2] with a grating spectrometer and the spectrum of ethylene near 950 cm^{-1}.

Recently the solar spectrum in this region has been remapped at Columbus, Ohio, with a 3600 line/inch replica echelette grating. Comparison with our own laboratory spectra of the band of ethylene near 950 cm^{-1} shows that there appears to be no sign of the ethylene fine structure on our solar spectra. In particular, there is no indication of the intense Q branch at 950 cm^{-1}, which suggests that the amount of ethylene in the earth's atmosphere must be extremely small.

Laboratory spectra have been taken near the position of the ethylene Q branch using an absorption cell 15 cm long filled with known amounts of ethylene. Because of the difficulty of measuring low pressures accurately, air was added to give atmospheric pressure for all spectra. Two such spectra are shown in Fig. 1.

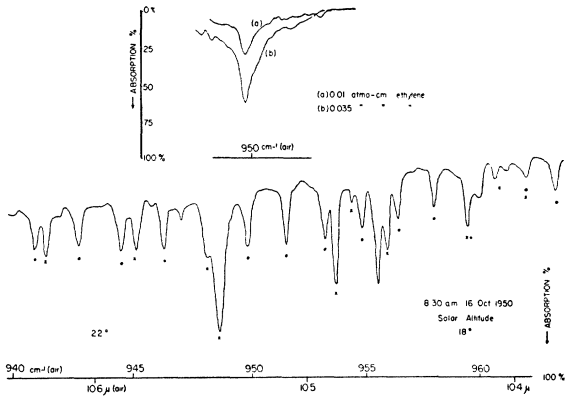

FIG. 1. Upper Curves: Laboratory spectra of ethylene showing Q branch at 949.76 cm^{-1}. Lower Curve: Solar spectrum from 940 to 960 cm^{-1}.

Beneath these is a solar spectrum taken at low solar altitudes to enhance atmospheric lines in this region. The regularly spaced series of weak lines marked with a dot belong to the band of CO_2 centered at 961 cm^{-1} which has been measured in the laboratory by Barker and Adel[3] and observed in the solar spectrum by Adel.[4] Most of the remaining lines in the solar spectrum have been identified with water vapor by comparison with a laboratory spectrum of an 8-meter path of steam near atmospheric pressure. The positions of lines in this laboratory spectrum are marked with an "x" in the figure.

Our frequency measurements show that the ethylene Q branch at 949.75 cm^{-1} (air) practically coincides with one of the most intense CO_2 lines (949.76 cm^{-1}), making a direct estimate of the amount of ethylene in the atmosphere impossible. Nevertheless, a very low upper limit may be set by considering the width and intensity of this line in the solar spectrum.

Thus, although the Q branch is very much wider than the CO_2 lines, measurements have shown that the overlapping CO_2 line in the solar spectrum has approximately the same width as neighboring CO_2 lines, indicating that the contribution of ethylene to this absorption is negligible.

In addition, the theoretical distribution of intensities of the CO_2 lines in the band was computed, assuming a temperature of 250°K. A series of solar records has been obtained at solar altitudes varying from 15° to 60° during the summer months of 1950. The peak absorptions of the CO_2 lines were measured on the individual records and compared with the theoretical distribution. Although the overlapping CO_2 line is one of the strongest lines in the band, it was found that in no case did it show an anomalously large intensity compared with other lines to within the experimental error of about 3 percent.

It must therefore be concluded that if ethylene does exist in the atmosphere, the amount present must be much smaller than the 0.01 atmos.-cm giving the absorption in the figure.

From the work now in progress on the solar spectrum from 7 to 13μ it is hoped that upper limits will be set to a series of other suspected atmospheric gases.

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Scintillation Spectra of As^{76}

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THE radiations of As^{76} have been investigated extensively in the past. Gamma-rays of approximately 0.57, 1.2, and 1.75 Mev have been reported by Siegbahn[1] and Wu, *et al.*,[2] while Miller and Curtiss[3] have found, in addition to the above, a gamma-ray at 2.15 Mev. The present investigation also indicates the presence of this fourth gamma-ray.

Radioactive arsenic was prepared by thermal neutron bombardment of part of the National Bureau of Standards sample No. 83a (>99.99 percent purity) of arsenic trioxide. The resulting activity had a half-life of 27.6±1 hours with no indication of the presence of any other period. Figure 1 shows the spectra obtained with a single one-inch sodium iodide crystal. The high energy peaks were obtained with a stronger source. The observed energies are listed in Table I.

Further investigation of the spectra was made with a Hofstadter type two-crystal spectrometer.[4] The energies so determined are also listed in Table I. All energy determinations were based on calibrations with Cs^{137} and Co^{60}. The two crystal spectra, Fig. 2, clearly indicates the presence of four gamma-rays.

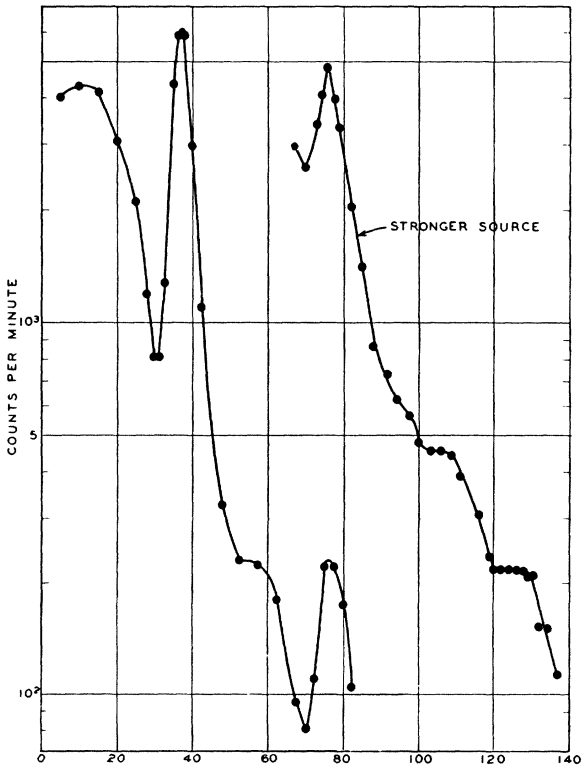

FIG. 1. Single crystal spectrum of As^{76}.

TABLE I. Gamma-rays from As^{76}.

Number	Energy from single crystal Mev	Energy from coincidences Mev
1	0.59	0.58
2	1.19	1.20
3	1.73	1.76
4	1.99	2.02

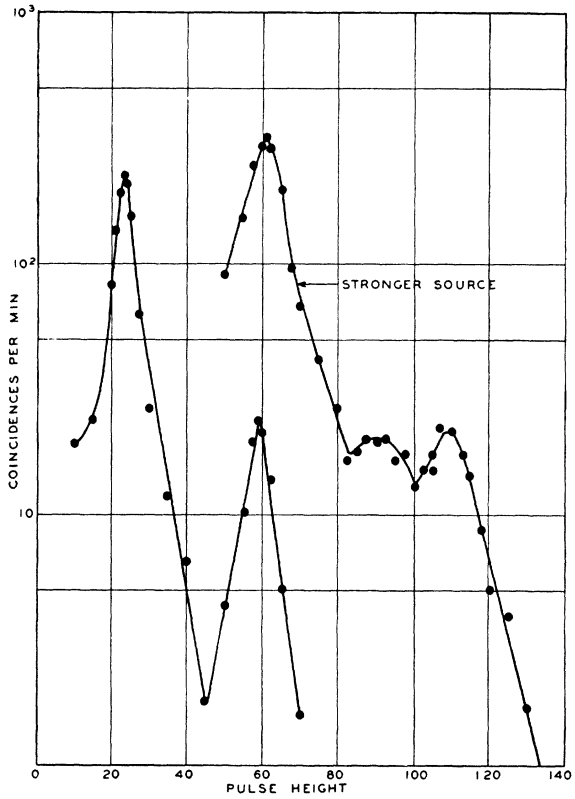

FIG. 2. Hofstadter-type two-crystal spectrum of As^{76}.

The two crystal curves were taken with the geometry described by the authors.[5] The gamma-ray energies were calculated from the observed recoil-electron energies together with the known degraded crystal geometry. If there is a cross-over gamma-ray of between 2.3 and 2.7 Mev as indicated by Myers and Wattenberg,[6] its intensity must be less than 10^{-4}

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Protons and the Aurora*

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AT the conference on Ionospheric Physics at Pennsylvania State College in July, D. F. Martyn presented a theory of magnetic storms and aurora which assigned a primary role to