

FIG. 1. Schematic diagram showing experimental arrangement for studying ultrasonic effects on solutions.

standing wave patterns in the solution, and these were observed by means of an optical schlieren system through the plane windows. The piezoelectric crystal was driven at a resonant frequency of approximately 400 kc/sec by an oscillator having an output of 500 watts. It was necessary to cool the transformer oil which coupled the crystal to the test cell in order to prevent excessive heating.

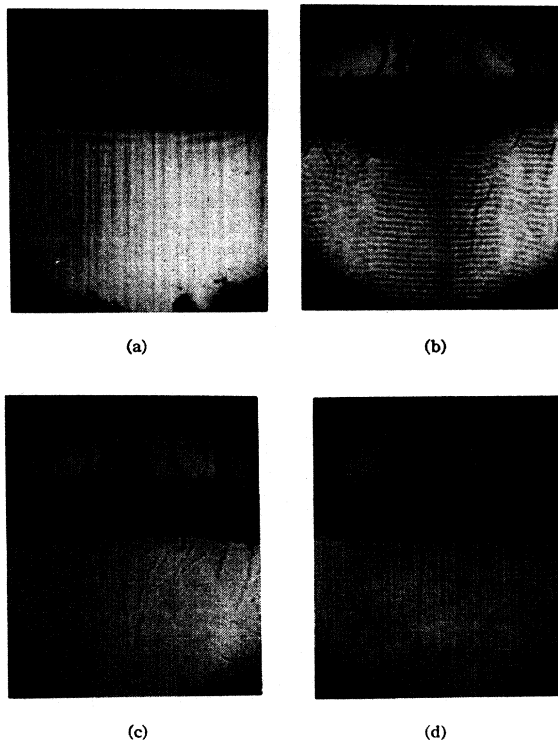


FIG. 2. Effect of ultrasonic irradiation on glycerin-H₂O solutions. Schlieren photographs taken at 1/50 sec. (a) Cell before ultrasonic generator was turned on. $T = 23.6^{\circ}\text{C}$. (b) Generator on 10 minutes. Temperature in front of reflector = 29.4°C . (c) Generator on 20 min, then turned off. Temperature in front of reflector = 29.3°C . (d) Six minutes after generator turned off. Temperature in front of reflector = 27°C .

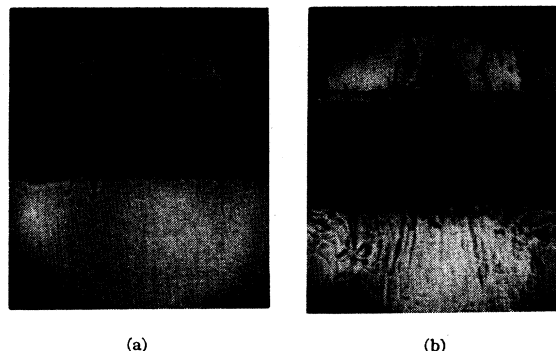


FIG. 3. Effect of heating reflector plate in position with photoflood lamp. (a) Reflector heated by photoflood, initial $T = 26.7^{\circ}\text{C}$, T in dark zone = 35.7°C . (b) Dark zone diffusing away after photoflood turned off.

The solutions used in the experiments were approximately 50 percent by weight of glycerin dissolved in water.

A typical run is illustrated in Fig. 2. It was noticed that as the runs progressed, a dark cloud, as seen in the schlieren system, indicating a zone of different refractive index would form in front of the reflector plate. This persisted after the ultrasonic generator was turned off. Samples taken from this region and analyzed, indicated an increase of approximately 6 percent in the glycerol content over that measured in the bulk of the solution. However, a local temperature increase directly in front of the reflector of approximately 6°C was noted.

In order to check upon the influence of this temperature increase on the concentration of the solution in the vicinity of the reflector, another series of runs were made in which the back of the reflector was coated with lampblack and heated locally by focusing a spot of light on it. The ultrasonic generator was not turned on during these runs. Figure 3 illustrates a typical run made in this manner. The same type of dark cloud was formed, and analyses showed a glycerin concentration increase comparable with that obtained in the ultrasonic runs.

Additional experiments were also made in which samples were withdrawn by means of capillary pipette directly from the nodes and antinodes of the standing waves. While small variations were observed from sample to sample, no direct and consistent correlation between position and concentration was found.

On the basis of these experiments, it seems likely that the solution separations reported by Frei and Schiffer were caused by secondary thermal effects due to ultrasonic local heating.

¹ H. Frei and M. Schiffer, *Phys. Rev.* **71**, 555 (1947).

Radioactive I¹²²

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AN activity with a 4-minute half-life in the iodine fraction obtained by bombarding antimony with high energy alpha-particles was reported.¹ The decay was by positron emission with an energy of 2.9 ± 0.1 Mev. The suggested reaction was $\text{Sb}^{121}(\alpha, 3n)\text{I}^{122}$.

If the above suggested assignment be correct, then it should be possible to produce this isotope by bombarding tellurium with protons. For this purpose Hilger tellurium metallic powder, Lab. No. 2433B, was bombarded with 7.4-Mev protons. By using a Geiger tube placed in a magnetic field so that positive and negative beta-particles could be observed selectively, a 3.6-minute half-life positron activity, as well as the 25-minute negation activity² of I¹²⁸, were obtained.

In order to find out which particular isotope of Te had acted as the target nucleus for producing the 3.6-minute activity, it was

necessary to use a Te sample with a different isotopic composition. This was accomplished by using enriched tellurium in which the content of Te^{122} had been increased from the natural abundance of 2.46 to 79.4 percent. Using 7.4-Mev protons again, the 3.6-minute activity was produced 46.5 times larger in intensity than the 25-minute activity, whereas in the previous case where Hilger material had been used the 3.6-minute activity was 1/4.4 times as large. The ratio of these two relative numbers, 46.5 and 1/4.4, which is 205, is very close to the ratio of the abundances of Te^{122} and Te^{128} for the two bombarded samples, namely, 210. It is thus concluded that the 3.6-minute activity is made from Te^{122} .

The 3.6-minute activity must then be attributed to either I^{122} by the (p, n) reaction or to I^{123} by the (p, γ) reaction.

Though in general the (p, n) reaction proceeds with a larger yield than the (p, γ) reaction, nevertheless it was considered desirable to examine the relative branching of these two reactions on other neighboring isotopes of Te. In particular, Te^{124} and Te^{126} had been bombarded with protons of the same energy. In both cases it was observed that the (p, n) reaction proceeded very readily whereas the (p, γ) reaction did not, with any appreciable yield.

It seems, therefore, reasonable to conclude that the strong 3.6-minute activity be assigned to I^{122} .

By absorption measurements the maximum energy of the positron spectrum was found to be 3.08 ± 0.1 Mev.

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¹ L. Marquez and I. Perlman, Phys. Rev. **78**, 189 (1950).

² "Nuclear data," Natl. Bur. Standards Circ. 499 (1950).

Resonant Absorption of Oxygen at 2.5-Millimeter Wavelength*

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A SINGLE resonant absorption peak of oxygen has been theoretically predicted to occur near 2.50-millimeter wavelength.¹ Because of the difficulties of making measurements in this region of the spectrum, the line has not previously been observed. With the millimeter wave harmonic generators previously described² and with the Zeeman modulation spectrograph developed in this laboratory³ for detecting the resonant lines of oxygen in the 5-mm wave region, we have succeeded in detecting and accurately measuring the 2.5-mm line. Its position and line breadth are given in Table I. Figure 1 shows a recorder tracing of the line both at room temperature and at the temperature of dry ice. The line position deviates only 25 Mc from that predicted by Van Vleck¹ with Schlapp's formula.⁴ Because of the low intensity of the line, an accurate measurement of its breadth could not be made. However, from measurements as accurate as we could make, the breadth appears to be greater than for the other lines in the millimeter region.⁵

The 2.5-mm line corresponds to the $J=0 \rightarrow 1$, $K=1$ transition in the spin-type triplet. The Zeeman pattern for this transition is particularly simple, and has been completely resolved. It consists of two components, of equal intensity, corresponding to $\Delta M = \pm 1$, which are shifted equally one to higher and one to

TABLE I. $J=0 \rightarrow 1$, $K=1$ line of oxygen.

Frequency Mc/sec	Line breadth parameter	Zeeman displacement of each component ($\Delta M = \pm 1$) Mc/gauss
$118,745.5 \pm 0.3$	$0.12 \text{ cm}^{-1}/\text{atmos}$ ($T=193^\circ\text{K}$)	1.70 ₆

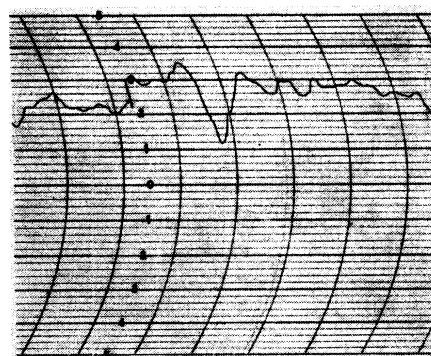
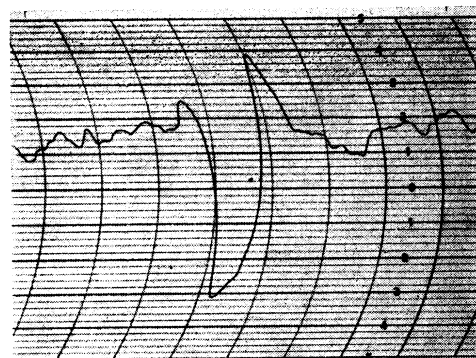


FIG. 1. Recorder tracings of the $J=0 \rightarrow 1$, $K=1$ transition of oxygen occurring at 118,745.5 Mc. The upper recording shows the line at dry ice temperature and the lower at room temperature.

lower frequencies by the magnetic field, and a third component corresponding to $\Delta M = 0$ which is not displaced by the field. The undisplaced line cannot be detected with the Zeeman modulation method used here. Hence, only the two lines corresponding to $\Delta M = \pm 1$ were observed. The recorder tracing of these components is shown in Fig. 2. Figure 3 shows the measured displacements of these lines as a function of field strength. It is seen that the displacement is directly proportional to the field up to the highest value employed (22 gauss). Thus it appears that the first-order Zeeman treatment (weak field case) should account satisfactorily for the splitting. However, the g factor observed, 1.22 ± 0.05 , does not correspond to that predicted, 1.00, for the normal Zeeman effect of Hund's case (b). So far we have been

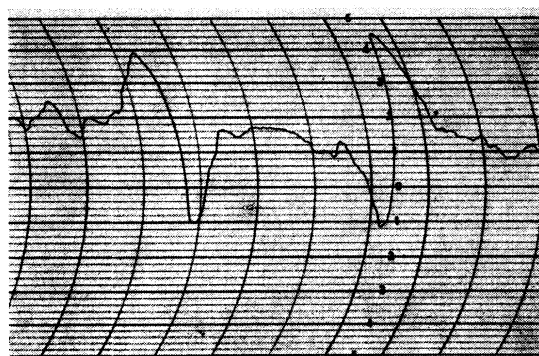


FIG. 2. Recorder tracing of the $J=0 \rightarrow 1$, $K=1$ transition of oxygen, showing the Zeeman splitting of the line into $M=+1$ and $M=-1$ components. The field in this case was 22 gauss.