for this inefficiency (7 percent) and for the expansion of the gas (15 percent) is 0.78 ± 0.13 g^{-1} day^{-1} and 0.57 ± 0.13 g^{-1} day^{-1} for one or more and three or more prongs, respectively. The ratio of the latter rate to the rate measured in photographic plates[2] is 1.42 ± 0.34, while the ratio of the nuclear area per gram of argon to that of the photographic emulsion, not counting the hydrogen present, is 1.17. Our results are thus not in disagreement with the emulsion work if N-rays have geometric cross section for nuclear interaction.

In a total operating period of 1009 hours, during which the chamber was not always operating at high enough efficiency for absolute rate measurements, the total number of gas stars observed was 95. In 5 cases the initiator was identified as a charged particle by its low ionization, its location in the upper hemisphere with reference to the star origin as center, and by the requirement that the backward extension of its path pass through counters above the cloud chamber which were discharged in coincidence with the ionization chamber. If charged and neutral N-rays have the same mean free path for nuclear interaction, this indicates that about 5 percent of the sea level N-rays are charged.

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Induced Infrared Absorptions of H_2, N_2, and O_2 in the First Overtone Regions

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INFRARED absorptions at the fundamental frequencies have been observed in the compressed gases H_2, N_2, and O_2 and in mixtures of these with foreign gases.[1–3] The experimental evidence is consistent with the hypothesis that the absorption is caused by the distortion of the charge distribution of the absorbing molecule during a close two-body collision. The theoretical calculations of Van Kranendonk and Bird[4] support this hypothesis. In recent experiments on H_2, N_2, and O_2 at high densities, absorptions in the regions of twice the fundamental frequencies have been observed.

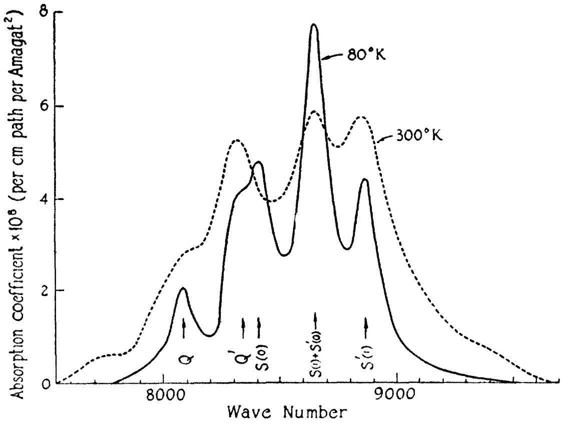

FIG. 1. Contours of the induced infrared absorption of hydrogen in the overtone region.

These absorptions were obtained using two transmission cells: a medium pressure (150 atmos) cell of 85-cm path length, and a high pressure (1500 atmos) cell of 30-cm path length. The medium pressure cell could be cooled to liquid air temperatures, and was used to investigate the temperature dependence of the H_2 absorption.

The integrated absorption coefficient of the overtone absorption in H_2 at both 80°K and 300°K varies as the square of the density up to 426 and 676 Amagat, respectively. The specific integrated absorption coefficient for the overtone is 3.5×10^{-5} cm^{-1} per cm path per $Amagat^2$ at 80°K and 6.2×10^{-5} at 300°K; for the fundamental it is 1.1×10^{-3} cm^{-1} per cm path per $Amagat^2$ at 80°K and 2.5×10^{-3} at 300°K. The specific absorption coefficient for the overtone plotted against wave number is shown in Fig. 1 for both temperatures. The low temperature contour shows five distinct components. The frequencies 8080, 8415, and 8645 cm^{-1} are in good agreement with those calculated for the Q, $S(0)$, and $S(1)$ lines of the $v=0$ to $v=2$ transition using the constants of the free molecule.[5] The frequencies 8320, 8645, and 8865 cm^{-1}, marked Q', $S'(0)$, and $S'(1)$ in Fig. 1, agree with those calculated using the expression $2\omega_e-4x_e\omega_e$ for the frequency of the Q-branch. The variation in the intensities of the lines as the temperature, and hence the ortho-para ratio, was changed confirms the above assignments. Thus we conclude that the observed absorption is a superposition of two bands. The frequency analysis suggests that the lower frequency band is the first overtone and that the higher frequency band corresponds to a double transition in which both H_2 molecules in the collision undergo the fundamental transition simultaneously. This interpretation is as yet speculative, and is being tested by experiments on the enhancement of the absorption by foreign gases.

An absorption at the overtone frequency of N_2, 4632 cm^{-1}, was observed in a 22.6-cm path of liquid N_2, and in the 30-cm path of the high pressure cell at room temperature with a gas density 81 percent that of the liquid. On the assumption of a density-squared dependence, the specific integrated absorption coefficient in both the liquid and the gas is 1.4×10^{-6} cm^{-1} per cm path per $Amagat^2$. The ratio of the specific integrated absorption coefficient of the overtone to that of the fundamental absorption is 1:66. An absorption was also observed in the region of twice the fundamental frequency of the O_2 molecule, 2900–3300 cm^{-1}, using the 85-cm cell at room temperature and O_2 densities up to 134 Amagat. The ratio of overtone to fundamental intensity is 1:30 in this case.

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Photoproton Reactions in Lead

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IN 1946 Baldwin and Klaiber[1] obtained a 4.5-minute thallium activity when lead was irradiated with 100-Mev x-rays. They attributed this to a mixture of 4.76-minute Tl^{207} and 4.23-minute Tl^{206} (at that time incorrectly assigned to Tl^{204}). Any or all of the reactions $Pb^{208}(\gamma, p)Tl^{207}$, $Pb^{207}(\gamma, p)Tl^{206}$, $Pb^{208}(\gamma, d)Tl^{206}$, and $Pb^{208}(\gamma, pn)Tl^{206}$ would produce these activities.