was obtained after a considerable amount of rather tedious experimentation by the trial and error method.

Since the solution contains positive and negative compounds (and traces of numerous impurities), the brightening of the transmitted light under the influence of the transient magnetic field can be accounted for upon the hypothesis that the compounds present in the solution have different Faraday time lags and thus set up rotation of the plane of polarization at different times after the application of the field. The maximum instantaneous field due to the high tension transient currents, as computed from our experimental data, is less than the strength of the steady magnetic field which gave no rotation.

FRED ALLISON
JOHN L. CONDON
Department of Physics,
Alabama Polytechnic Institute,
May 28, 1932.

Dependence of the Ionization Produced by the Cosmic Penetrating Radiation upon Pressure and Temperature

Compton, Bennett and Stearns[1] have recently offered an explanation of the ionization-pressure relation at high pressures in terms of a selective recombination at these pressures. On this basis they have been able to approximate closely the experimental ionization-pressure curves and to explain to some extent the difference in the ionization produced by the penetrating radiation in different gases.

An interesting feature of this explanation is that it indicates a dependence of the ionization produced in a given quantity of gas upon the temperature of the gas. According to the theory the variation with temperature is negligible at pressures in the neighborhood of 1 atmosphere but increases with pressure and becomes considerable in the neighborhood of 100 atmospheres.

In testing the theory, Compton[1] and his associates found that "Two series of readings on air at 100 atmospheres pressure, taken between 0° and 30°C and between 0° and 37°C, showed greater ionization at the higher temperature by 7.8 percent and 8.3 percent respectively. Only one set of temperature readings was made at a lower pressure. This was for nitrogen at 20 atmospheres. The observed effect was 0.0000 ± 0.0003, whereas the predicted value of $\beta(=\delta i/\delta T)$ for nitrogen at this pressure is 0.0004."

The ionization in the above work was produced by gamma-rays. Stearns informs me that he has recently investigated the temperature variation of the ionization produced by the cosmic penetrating radiation in oxygen at a pressure of 70(?) atmospheres, and has found an effect corresponding to that previously observed with the gamma-ray ionization at 100 atmospheres.

Wolff[2] has very recently investigated the temperature variation of the gamma-ray ionization in CO_2 and N_2 at 21.5 atmospheres. He observed an increase of 10 percent in the ionization in CO_2 and 5.3 percent in that in N_2, upon increasing the temperature from 1° to 38°C.

The writer has investigated the temperature effect in the ionization produced by the penetrating radiation in the 13.8 liter spherical chamber described elsewhere[3] in detail, with the 5.5–6 ft. water shield. With constant amount of air and a mean pressure of 162.1 atmospheres, the ionization was observed to increase 7.0 percent of the smaller value when the temperature was increased from 7.5° to 40.5°C. Under similar conditions but with a mean pressure of 23.3 atmospheres, the ionization increased 8.7 percent of the smaller value when the temperature was increased from 14.45° to 47.25°C. These values are without corrections for variations in barometric pressure or for variations in the density of the shields. The barometric pressure was practically the same during the high and low temperature observations at the higher pressure, but at the lower pressure the barometric pressure during the high temperature observations was low, perhaps enough to have augmented the variation in ionization by an amount of the order of 1 percent. However, intermediate temperature observations at the higher pressure indicate that the variation of the ionization with temperature is greater at

[1] A. H. Compton, R. D. Bennett and J. C. Stearns, Phys. Rev. **39**, 873 (1932).

[2] Kurt Wolff, Zeits. f. Physik **75**, 570 (1932).

[3] J. W. Broxon, Phys. Rev. **37**, 1320 (1931).

higher temperatures. In fact, when the temperature rate of variation of the ionization at the high and low pressures is considered as a function of the temperature, the indication is that the temperature effect may be nearly independent of the pressure.

Apparent slight dependence of the ionization upon time rate of change of temperature or upon the previous condition of the gas has also been observed. Soon after filling the chamber to a high pressure very large ionization values (sometimes about twice the equilibrium values) were observed, even though the gas appeared to have assumed a nearly constant temperature and the ionization current had been flowing for several minutes. Soon after reducing the pressure the ionization was also somewhat greater than the final steady value, but no differences as large as those following compression were observed.

JAMES W. BROXON

University of Colorado,
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