The Dellinger Phenomenon

In his review[1] of the problem of sudden disturbances of the ionosphere, J. H. Dellinger suggests that the source of the sudden ionization changes must be of a character distinct from the source of ionization in the E, F, and F_2 layers since the disturbance has to come through these layers. The level at which the effect is produced is one where the density is great enough to insure numerous collisions of moving ions and rapid recombination of the ions. Recent observations of the new high pressure nitrogen afterglow, in which the $^2P-{}^4S$ nitrogen line and the Vegard-Kaplan bands are very strong, have shown the presence in the spectrum of the afterglow of the Goldstein-Kaplan bands and of a number of new bands, the most prominent of which is at 3246A. Weaker than the other features of the afterglow spectrum, but definitely present, are the first-negative or auroral bands of N_2^+. An examination of some old high pressure discharge spectra in pure nitrogen shows the N_2^+ bands, the Goldstein-Kaplan bands, and the new 3246 bands, thus clearly pointing to this combination of band spectra as having some physical connection. By varying the magnitude of the current in the exciting discharge in the high pressure afterglow experiment, it has been possible to show definitely that with increasing current these three "connected" features decreased together as the current increases. One possible explanation of this interesting observation is that the Goldstein-Kaplan system and the new 3246 system are produced by the recombination of nitrogen molecule ions or at least are closely connected with the behavior of these ions.

The connection between the above observations and the Dellinger phenomenon is that we have here a laboratory observation of the type of radiation that occurs when nitrogen molecule ions are produced at high pressure. Since this is exactly the sort of phenomenon that Dellinger postulated as the cause of the sudden disturbance, it suggests that the radiation associated with it should be studied for the purpose of understanding the mechanism and hence the cause of this phenomenon more clearly. These experiments are now under way in the writer's laboratory.

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[1] J. H. Dellinger, J. App. Phys. **8**, 732 (1937).

Radioactive Isotopes of Element 43

In a previous paper[1] we have reported the results of activity measurements of a molybdenum target which had been bombarded with deuterons of the Berkeley cyclotron. It has been shown that the activity must be ascribed to radioactive isotopes of element 43[2] and it is mainly owing to low energy electrons; a component of the radiation was found to be due to electrons having a half-value thickness of about 1.4 mg/cm^2 Al absorber and a half-value period of 90 days. Besides it was observed that there were also some other components of higher energy but it was rather difficult to identify them on account of the small activity of our sample.

With a new molybdenum target which has been bombarded in the cyclotron and kindly sent to Palermo by Professor E. O. Lawrence, it has been also possible to study the harder γ-components of the radiation emitted by element 43. The measurements here reported started at the beginning of January, 1938 and extended over a period of 9 months. The activity was measured with an ionization chamber closed by 2 Al foils of 0.001 mm thickness for the measurements of the decay constants, and with a Geiger-Müller counter tube for the absorption measurements and for magnetic deflection experiments. It is found that the radiation emitted by the Mo sample has a γ-component with a half-value period of 62 days and a half-value thickness of about 2.5 g/cm^2 Al. Furthermore the absorption curves in Al of the total radiation taken at different times show that there is some other component of radiation on which at present it is not possible to give any sure information. Absorption curves in Al were taken for nine months at different times, and corresponding to each thickness of Al absorber a decay curve was drawn. All these decay curves are apparently exponentials although really resulting from the composition of two or more exponentials. In Fig. 1 the values of the total radiation half-lives are plotted as a function of the Al absorbing thickness. It is then seen that at the beginning of the curve, where the strong soft electron component of the radiation is predominant, the half-value period is 90 days, while at about 12 mg/cm^2 and for all the greater absorbing thicknesses measured (up to 600 mg/cm^2 Al) the half-value period has the constant value of 62 days.

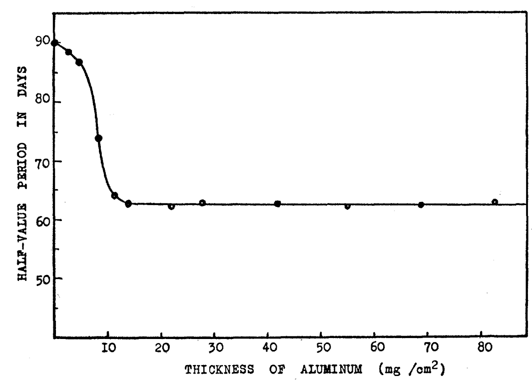

FIG. 1. Half-value period of the radiation emitted by element 43 as a function of the Al absorbing thickness.

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[1] B. N. Cacciapuoti, E. Segrè, Phys. Rev. **52**, 1253 (1937).
[2] C. Perrier, E. Segrè, J. Chem. Phys. **5**, 712 (1937); Lincei Rend. **25**, 723 (1937); **27**, 579 (1938).