number of discharges produced in one of the two counters. For this purpose, switchings were effected in the amplifier by means of a barograph about every 5 minutes. The number of switchings indicated the pressure data.

The apparatus functioned for 58 minutes. Judging by the data of the three observers—which were in fairly good accord—the number of the coincidences produced by the vertical beam of cosmic rays increased with the increase in altitude as follows: up to the altitude of 5 km. by 9 times; up to 7 km. by 18 times; up to 9 km. by 27 times. At greater heights the number of coincidences ceased to increase and the last observation, obtained at the altitude of 12·2 km., even showed a slight fall.

The number of discharges produced in one counter increased up to the altitude of 6 km. by 3·5 times; up to 7·5 km. by 6 times. At greater altitudes (up to 13·6 km.) the number of discharges became too great to be counted, but the intervals were used for tuning the receiver.

The apparatus ceased to function at the altitude of 13·6 km. as soon as the balloons started descending after one of them had burst.

It seems that the method described may be used for the study of cosmic rays at great altitudes, especially in thinly populated localities (near the equator and in the arctic region), where finding self-recording apparatus would present considerable difficulty.

In conclusion, I wish to express my sincere thanks to Prof. P. Moltchanoff for his continued interest, his many helpful suggestions and for the organisation of the flight.

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The Phosphorescence Process as Revealed by the Luminescence from Solid Nitrogen

SOME years ago it was found by me that a number of bands appearing in the afterglow of solidified nitrogen were due to forbidden transitions from metastable, molecular electronic states.

The appearance of bands from forbidden transitions in the crystalline state was explained by the fact that they only appear in the α-form of nitrogen where the molecular axes are fixed in the lattice, while they are absent in the β-form where the molecules rotate[1].

This result would suggest that the rate of decay of the afterglow was determined by the probability for the occurrence of the forbidden transition. This view, however, could not be upheld because the rate of decay sometimes is very slow and does not follow an exponential law.

In order to explain the phosphorescent property (afterglow) of nitrogen, it was assumed[1] that the bombarding rays produced a dissociation of the molecules into atoms which might be neutral or ionised.

Energies corresponding to the elementary process of the chemical reaction were transferred to the molecules in such a way that they were brought into an excited state with electrons raised to higher levels. In this way the phosphorescence appears to be closely related to chemi-luminescence. The difference is mainly that in the case of phosphorescence the reacting substances have first to be produced by means of radiating quanta.

This view has recently obtained an interesting confirmation by the study of the ε-system (Vegard-bands) from solid nitrogen, which some years ago was shown by me to result from the forbidden electronic transition from the $A(^3\Sigma)$ level to the normal state $X(^1\Sigma)$ of the nitrogen molecule.

For the upper state A (bottom state of the first positive group) we know at least 15 vibrational levels. For the ε-system no bands are known starting from a vibrational level (A) with quantum numbers n' greater than 7. A few bands were observed for $n' = 7$, and for all values of n' equal to or smaller than 6 a large number of bands were observed.

This sudden break in the vibrational states of the upper ε-level was first explained by means of the potential curves for the upper and lower state and by a reasoning similar to that underlying the Franck-Condon theory of intensity distribution of vibrational bands.

Recently, more accurate determinations of the potential functions have shown that this explanation can scarcely be maintained. The abrupt limit of the upper vibrational states, however, can be accounted for, if we assume that the ε-system—which also remains in the afterglow—is excited through recombination of normal nitrogen atoms formed during the ray-bombardment.

The dissociation energy of nitrogen has been determined by Herzberg and Sponer[2], and recently the value $D(N_2) = 7{\cdot}345$ volts was given by Büttenbender and Herzberg[3].

The energy necessary to excite the vibrational states $n' = 7$ and $n' = 8$ of the A-level is 7·29 and 7·45 volts respectively. The dissociation energy $D(N_2)$ is just sufficient to excite the $n' = 7$ state, but too small to excite the level $n' = 8$.

The assumption that the ε-system afterglow is due to a recombination of nitrogen atoms (chemical reaction) thus accounts for the fact that ε-bands occur for $n' = 7$, but not for n' larger than 7.

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May 25.

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The Solution, by the Method of Association, of Problems in Inverse Probability

IN his review[1] of a book by Sir Arthur Eddington, Prof. Dingle criticises Sir Arthur's solution of a certain problem in inverse probability. Prof. Dingle proposes a second, simpler, and analogous, although different, problem: If A and D each speak the truth once in three times independently, and A says that D lies, what is the probability that D speaks the truth? He argues that from our knowledge of D, the probability is 1/3, while from our knowledge of A it is 2/3, and hence that neither for his problem nor for Eddington's can there be any consistent, correct solution. Yet Prof. Dingle's problem can be regarded