

Dr. P. ZEEMAN. *Measurements of the Absorption of Electrical Vibrations in different Electrolytes.*

1. For the determination of a coefficient of absorption of electrical vibrations in an electrolyte, communicated to the Academy last month ¹⁾, I was obliged to postulate, that it is allowed ²⁾ to diminish the deflections of the bolometer with the constant amount observed at the end of the basin. It would certainly require considerable labour to demonstrate that this supposition was really permitted.

However I succeeded in arranging the experiment in such a manner that considerable perturbations were excluded and I could make disappear almost completely the mentioned constant deflection at the end of the basin. Now the energy, at the end of the basin is really quite absorbed. ³⁾

It appeared to me, that there are several causes capable of producing such a constant deflection, to

¹⁾ ZEEMAN. Verslagen Kon. Akad. Zitting 26 October 1895. This Communication. pag. 3.

²⁾ l. c. pag. 8.

³⁾ l. c. pag. 6.

wit 1°. insufficient polishing of the balls between which the spark passes; 2°. too great viscosity of the isolating fluid used; 3°. great resistances in the wires connecting the induction coil with the balls; 4°. capacity in these wires; 5°. conductors attached to LECHER's wires; 6°. induced currents in the wires connecting the little jars with the bolometer.

In my experiments 1 and 2 were the chief disturbing causes.

As soon as this had appeared to me, it was easy to avoid these errors. As for the rest the disposition of the experiments remained the same as described in the preceding communication.

2. For a solution of common salt of about the same concentration as that used earlier, I have again, under the more favourable circumstances, measured the absorption. The results are in accordance with those found on a former occasion. However the results now found are of more importance, not only because of the improvement (1), but also on account of the improved technics of the method of observation.

It appeared to me of some interest to compare the absorption of a solution of chloride of sodium with that of another of the same conductivity. I have chosen for that second solution one of sulfate of copper

Both the solutions were of a conductivity 3340.10^{-10} that of mercury, the temperature during the observations being $\theta = 18^{\circ}.0$.

The following table, relating to the observations on copper sulfate, may serve as an example of the experiments.

Traversed layer.	Observed deflection.			Mean.	Deviation from mean.		
0	47	47	47	47	0	0	0
2.5	27	30	27	28	- 2	+ 2	- 1
5	16	24	17	19	- 3	+ 5	- 2
7.5	14	10	15	13	+ 1	- 3	+ 2
10	7	11	9	9	- 2	+ 2	0
15	0	7	5	4	- 4	+ 3	+ 1
20	3	0	2	1.7	+ 1.3	- 1.7	+ 0.3
47	0	0	0	0	0	0	0

The second column contains the deflections, observed in 3 series, of the bolometer, the third the mean of the deflections, the fourth the deviations from the mean. Altogether 18 series of observations were made with copper sulfate. In order to point out that by combination of the observations the accuracy is increased, I have combined the result of 6 series and I have again compared the 3 series, obtained in this manner, with their mean. This mean may be considered as representing the result for copper sulfate.

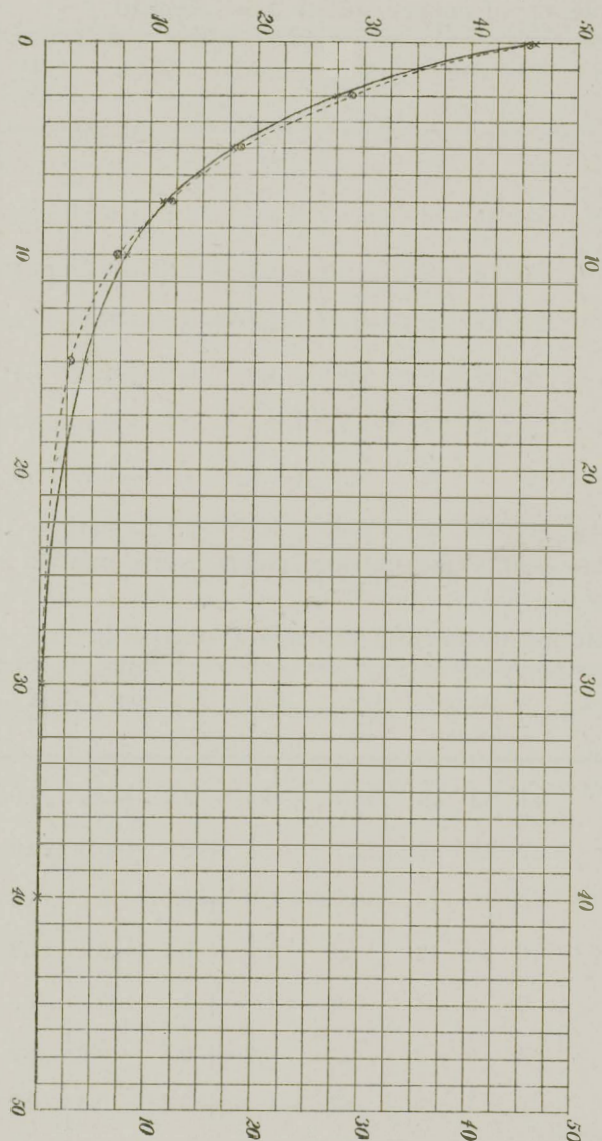
Solution of copper sulfate $\lambda = 3340.10^{-10}$.

[illegible]

The results for sodium chloride are entered in the same manner.

Solution of sodium chloride $\lambda = 3340.10^{-10}$, $\theta = 18^{\circ}.0$

Traversed layer.	Observed deflection.	Mean.	Deviation from mean.	Calc.	Observ. calcul.
0	46 43 48	45.7	+ 0.3 — 2.7 + 2.3	46.0	— 0.3
2.5	27 28 28	27.7	— 0.7 + 0.3 + 0.3	29.0	— 1.3
5	16 20 18	18.0	— 2.0 + 2.0 0	18.3	— 0.3
7.5	10 12 12	11.3	— 1.3 + 0.7 + 0.7	11.6	— 0.3
10	7 9 8	8.0	— 1 + 1 0	7.3	+ 0.7
15	4 5 4	4.3	— 0.3 + 0.7 — 0.3	2.9	+ 1.4
31	0 1 0	0.3	— 0.3 + 0.7 — 0.3	0.2	+ 0.1
47	0 0 0	0	0 0 0	0	0



The general course of the deflections appears to be the same for the two solutions within the limits of the errors of the observations. In the fig. is given the curve for common salt. The dotted line represents the formula $46.e^{-2pz}$, $p = 0,092$ being the value most closely approaching the observations. In order to make it clear how far goes the representation of the observations by the exponential formula, I have entered under »calculated», the computed values and in the last column the deviations from the observed deflections. The yet remaining deviations surpass a little the limit of the errors of observations and therefore require further investigation.

In order to avoid confusion in the figure the observations relating to copper sulfate are not graphically represented. They are represented in the same manner by $47.e^{-2pz}$, p being $= 0,090$. Hence the values of p calculated in this manner are the same in the two cases within the limits of the errors of observation. If other salts offer no deviations, we have for Hertzian waves in dilute aqueous solutions the law: *solutions of equal conductivity absorb in the same manner vibrations of the same period.*

Prof. COHN ¹⁾ has already remarked that for the vibrations which constitute light, there does not exist such a law. The great difference existing between the absorption of light- and electrical-waves, may also be expressed in another way. According to the theory of electrolytic dissociation dilute solutions containing

¹⁾ COHN. Wied. Ann. Bd. 45, pag. 59. 1892.

aequivalent quantities of a coloured ion absorb equally strongly the light of this colour. This is confirmed by OSTWALD's experiments. Aequivalent solutions of different combinations however may have *totally different* conductivities, hence the different behaviour of solutions with respect to the two kinds of vibrations is evident.

3. By the value of p and the data given in our last publication, sufficient data are known, to compare the observed absorption with that derived from theory. It is proposed to return to the subject on a future occasion.

The results obtained till now may be summed up as follows:

1. The intensity of electrical vibrations travelling through a layer 5,1 cm. in thickness of a solution of common salt, the conductivity of which is $\lambda = 3340.10^{-10}$ that of mercury decreases to $1/e$ of the original value. This result is now independent of a supposition necessary in my last communication.

2. In dilute solutions of equal conductivity vibrations of the same period are equally absorbed. cf. § 2.

COMMUNICATIONS

FROM THE

PHYSICAL LABORATORY

AT THE
UNIVERSITY OF LEIDEN

BY
PROF. DR. H. KAMERLINGH ONNES.

~~~~~  
**No. 23.**

**Dr. H. KAMERLINGH ONNES.** Remarks on the liquefaction of hydrogen, on thermodynamical similarity and on the use of vacuum vessels.

(Translated from: *Verlagen der Afdeling Natuurkunde der Kon. Akademie van Wetenschappen.* 25 Januari 1896.)

.....  
EDUARD IJDO — PRINTER — LEIDEN.