



## On the determination of the dielectric constant of glass by aid of very rapid electrical oscillations

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the upper ones contain pelagic shells. Dykes of augite and hyperthene-andesite project on the shore, and a representative of the plutonic series occurs. There is evidence that the island has been elevated and again submerged prior to the elevation which has raised it to the present height. The volcanic basis is largely invested with limestone, and this rock forms the summit 1078 feet above sea-level. Sections show that it is a shallow-water deposit.

Of the purely limestone structures, Tongatabu, Nomuka, and the long reef on which the larger islands of the Hapaii group are situated form more or less complete atolls, all of which have been elevated to a greater or less extent.

The Vavau group is remarkable for its very indented contour, suggesting the idea that it rests on a much denuded basis. Both here and at Eua there are raised limestone formations with atoll or barrier-like contours; and there is some direct evidence to show that these have been formed without the aid of subsidence.

The presence of islands formed of volcanic materials laid out in layers beneath the sea, and the manner in which the recently formed Falcon Island is now being reduced to the condition of a submarine bank, suggest that the atolls of the group may rest on similarly formed foundations.

4. "On the Inverness Earthquakes of November 15th to December 14th, 1890." By C. Davison, Esq., M.A.

In this paper the author gives reasons for supposing that the Inverness earthquakes of last year were due to the subsidence of a great wedge of rock included between a main fault and a branch one; and he considers that there is little doubt that these recent earthquakes were the transitory records of changes that, by almost indefinite repetition in long past times, have resulted in the great Highland faults.

### XXXII. *Intelligence and Miscellaneous Articles.*

ON THE DETERMINATION OF THE DIELECTRIC CONSTANT OF GLASS BY AID OF VERY RAPID ELECTRICAL OSCILLATIONS.  
BY R. BLONDIOT.

VERY rapid electrical oscillations, such as are produced by Hertz's apparatus, have been utilized by Prof. J. J. Thomson for the measurement of the dielectric constant\*. Prof. Thomson draws from his experiments the following conclusion: "for vibrations whose frequency is . . . 25,000,000 per second, the specific inductive capacity [of glass] is very nearly equal to the square of the refractive index, and is very much less than the value for slow rates of reversals."

As regards this conclusion we might demur to the use of the

\* J. J. Thomson, "Specific Inductive Capacity of Dielectrics when acted on by very rapidly alternating Electric Forces," Proc. Roy. Soc. June 20, 1889.

formula which gives the period of the oscillations, a formula the tenability of which is doubtful in the case of very rapid oscillations. More recently, E. Lecher has measured the dielectric constants of several substances by the aid of a method founded also on the determination of the wave-length of very rapid oscillations, but without employing any formula.

The conclusions of M. Lecher are diametrically opposed to those of Prof. Thomson: "Not only," says he, "does the dielectric constant, calculated by the aid of the capacity, not become smaller for very rapid oscillations, but it even considerably increases."

These contradictory conclusions have led me to engage in new researches; the method which I have adopted is based on the employment of very rapid oscillations, but I do not make use of any formula.

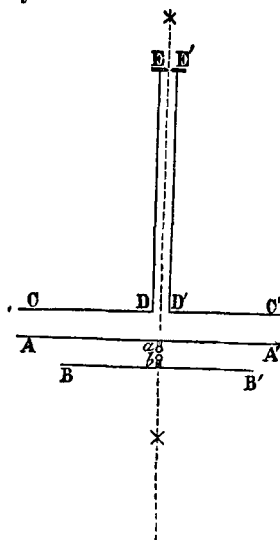
A large rectangular plate of copper A A' is fixed vertically; a second, smaller plate B B' forms a condenser with the first. This condenser can discharge itself by the intermediation of the knobs *a* and *b*; *a* is in communication with the gas-pipes, *b* with one of the poles of an induction-coil the other pole of which communicates with the gas-pipes. When the coil is working the condenser A B is the seat of oscillatory charges and discharges the period of which is of the order of the  $\frac{1}{25,000,000}$  of a second.

We have thus in the space situated on the side of A A' opposed to B B' a periodic electromagnetic field which—and this is the chief point—has  $\times \times$  as the plane of symmetry.

Let us fix in this field two square plates C D, C' D' parallel to A A' and symmetrical with respect to  $\times \times$ , and then solder to the middle points D, D' of their inner edges two wires terminating at E and E' in two carbon points kept facing each other at a very small distance apart.

Although the coil is working, we do not observe any light between E and E'; this results from the symmetry of the apparatus. If we interpose a glass plate between A A' and C D, sparks immediately pass between E and E'; this is caused by the induction received by C D becoming less strong than that received by C' D'.

Let us now interpose between A A' and C' D' a plate of sulphur; if we give to it such a thickness that the inductive action on C' D' is equal to that on C D, the sparks disappear between E and E'. Conversely, the disappearance of sparks between E, E' indicates



that the inductions transmitted to CD and C'D' are equal; it is sufficient therefore to measure the thicknesses of the dielectric plates to determine by an easy calculation the ratio of the dielectric constants of glass and sulphur. By means of experimental precautions which I cannot mention here I have been able to render this method sensitive and exact.

The glass plate which I employed was exactly 3 centim. thick. For the other side, I cast two plates of sulphur in the form of prisms of the same angle, in such a manner that by clipping them together, as in Babinet's compensator, a plate with parallel faces was formed the thickness of which could be varied. I found 3.15 centim. for the thickness of the plate of sulphur which exactly compensated the plate of glass. To complete the determination of the dielectric constant of glass that of sulphur had to be obtained; this was easy, since sulphur is a nearly perfect dielectric. I employed the method indicated by M. J. Curie\* and found the number  $2.94 = (1.67)^2$ .

This result is almost identical with that of Prof. J. J. Thomson. Maxwell's law is not exactly verified, as the mean index of my plate of glass is about 1.51, but the difference is much less than that given by the values of dielectric constants obtained by the aid of slower methods. My conclusion is the same as that of Prof. J. J. Thomson.—*Comptes Rendus*, May 11, 1891, p. 1058.

ON AN IMPROVED METHOD OF DETERMINING SPECIFIC HEAT BY  
MEANS OF THE ELECTRICAL CURRENT. BY PROF. PFAUNDLER,

The method published in 1869, which depends on Joule's law according to which the same current develops in spirals of wire arranged in series quantities of heat which are proportional to the resistances, has hitherto met with but few applications, owing to the fact that it is only applicable to nonconducting liquids. The author has got rid of this objection by replacing the spirals of wire by thin glass spirals filled with mercury. He obtained also greater accuracy and certainty by interposing these resistances as branches in a Wheatstone's bridge, so that it was possible to control the ratio of the resistances during the passage of the current and keep it constant. Slight alterations of the resistances were compensated by placing glass threads in the straight ends of the tubes which contained the mercury. In other cases those alterations were measured by displacing the contact-key, and in this way the result was corrected.

The comparative measurement of the rise of temperature is made more sensitive by the aid of a thermopile.

Experiments are communicated which show the applicability of the method both for direct and alternating currents.—*Wiener Berichte*, April 9, 1891.

\* *Ann. de Chim. et de Phys.* 1889.