quarter of our century,—the post-Pasteur period.

But in the last analysis it is the higher significance of bacteriology which must always be regarded as its most important characteristic. By virtue of the discoveries upon which it was founded, to which it has led and upon which to-day it rests illustrious and secure, mankind has been enabled for the first time to arrive at an adequate comprehension and understanding of the microscopic world and of many important and familiar natural phenomena hitherto either not understood or misinterpreted. The origin of bacteriology is interesting and instructive; its scope is broad and comprehensive; but these matters are of only moderate consequence as compared with its philosophical significance. At the beginning of our century, in absolute ignorance of bacteriology and its wonderful teachings, man gazed with wonder or indifference on some of the most familiar, yet most mysterious, of natural phenomena. Organic matters almost everywhere slowly 'decayed' and disappeared; sweet and sugary fruit juices 'turned' rapidly and 'spontaneously' into pungent or acid liquors; slow and innocuous 'decomposition' often gave place to foul 'putrefaction' and rapid 'decay' or destructive 'rots'; manure applied to land, even to land lying fallow, soon vanished altogether; 'epidemics,' 'plagues' and 'pestilences' swept over the earth, and man could neither understand, nor explain, nor intelligently fight them; the microscopic world quivered with forms of life which seemed to be born in a day and to disappear like dew. The heavens had long since revealed the glory of God, and the firmament,—thanks to the interpretations of Copernicus, Galileo and Newton,—had abundantly shown his handiwork. But the microscopic world still sat in the shadow of darkness, awaiting the disclosure of its meaning. At last, in the fulness of time and largely through the achromatic objective, a great light shone upon and from the under world. The mysteries of fermentation, putrefaction, organic decomposition, decay and the mineralization of organic matters were reduced to their lowest terms and brought into line with other problems of biology. Epidemics, plagues and pestilences were proved to be merely the ravages of micro-parasites; the life of the under world was scrutinized, classified and studied, and has been found to follow in general the same natural laws as that of the upper world. Bacteriology has given to us a comprehension of the under world similar to that which astronomy and astro-physics have given us of the heavens; the widely-accepted theory of present-day spontaneous generation has been proved to be a myth, and with the fading out of this ancient view of nature the last traces of medieval ideas of magic, alchemy and easy transmutation of the elements have disappeared from science.

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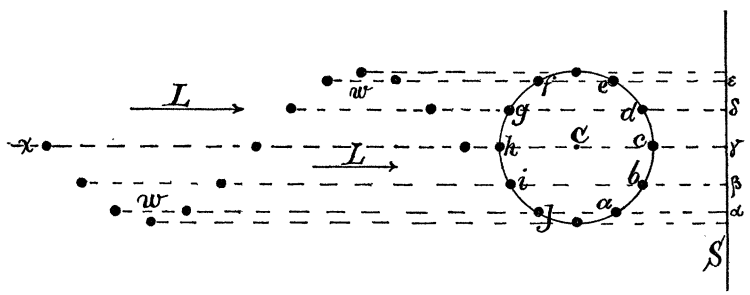
*CERTAIN STROBOSCOPIC PHENOMENA IN THE END-ON PROJECTION OF A SINGLE WAVE.*

In projecting a plane polarized wave machine wave, *ww*, with a lens on a distant screen, *S*, one observes when the wave is in vigorous motion that the balls appear on the screen as stationary objects, symmetrically disposed with reference to the axis of advance of the wave, or the direction of incident light, *LL*, and at distances apart corresponding to equal phase-differences. Clearly the same effect must be produced in rotating the circle of reference, *C*, if provided with balls, *a*, *b*, *c*—at equal angular distances apart on the circumference. As certain parts of this phenomenon are peculiar, I constructed a disk like *C* by soldering bright rods at right angles to its surface at *a*, *b*, *c*—with an axle at *C*.

When the disk revolves, however rapidly, in the beam of sunlight parallel to its surface as stated, the eye regarding the *inner* surfaces of the rods *a*, *b*, *c*, *d*, *e*, sees the usual sheen of light intersected with intensely black shadow bands due to *f*, *g*, *h*, *i*, *j*, projected in the positions *a*, *b*, *c*, *d*, *e*. The experiment is specially striking in a dark room. This phenomenon is easily explained, for the points *a*, *b*, *c*—are nodal points, as it were, or loci of perpetual eclipse.

The second phenomenon is even more striking: if the light after passing the revolving disk parallel to its face (which therefore is seen as a mere line) is caught on a screen, either close at hand without a lens, or at long range by lens projection, the loci $\alpha, \beta, \gamma, \delta, \varepsilon$, are again stationary, appearing however *bright* on a dark ground. Judged merely by the eye, the effect is just as if the rods where they cross in double thickness were perfectly transparent. It would take considerable acumen to predict this kinematic result.




Without entering into details, I may point out in explanation that every part of the area of projection, *S*, is swept by the shadow of each rod twice per rotation. The result must be perceptible and at first sight uniform darkening of the field. But whereas throughout the whole semicircle, *f*, *g*, *h*,—and also *between* the points *a*, *b*, *c*,—light has been removed backwards (*i. e.*, from the screen) by reflection, none has been removed at the points *a*, *b*, *c*; for these appear as black lines in the sheen of revolving rods. Hence more light must get through along the lines *fe*, *gd*, *hc*, than in the same direction between these lines.

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## THE INTERNATIONAL GEODETIC ASSOCIATION.

THE sessions of the Thirteenth General Conference of the International Geodetic Association were held at Paris, France, between the 25th of September and the 6th of October, 1900.

The following countries were represented at the Conference: Germany (8), Austria (2), Denmark (1), Spain (1), United States (1), Great Britain (1), Hungary (1), Italy (3), Japan (1), Mexico (2), Norway (1), Holland (3), Roumania (2), Russia (1), Sweden (1), Switzerland (1), France (8), the number following the name of each country indicating the number of delegates sent from the country. Belgium, Greece and Portugal were not represented.

At the opening session of the Conference the French Minister of Public Instruction presided, and welcomed the delegates in the name of the French Government. The sessions were held in the new Sorbonne, and a great many interesting reports were read. From these reports the following details have been extracted:

M. Schumann has undertaken a new computation of all the great arcs already measured, in order to deduce the elements of the terrestrial ellipsoid.