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(*Concluded*)

Measurement of star diameters by the interferometer method: F. G. PEASE. Stephan, in 1874, following a suggestion of Fizeau's, made an attempt at measuring the angular diameter of the brighter stars by the interferometer method and rightly found that his telescope was too small. Michelson in 1890 devised a periscopic attachment, which, when placed upon the end of the telescope greatly increased its equivalent aperture; with it he measured the diameter of the satellites of Jupiter. A similar instrument upon the great 100-inch Hooker telescope on Mount Wilson enabled Michelson and Pease in 1920 to obtain a successful measure of the angular diameter of α Orionis.

A brief outline is given of the principles underlying the method of interferometer measurement, and of its application to use with the telescope. Pencils of light from the star passing through two small apertures in a screen covering the telescope, produce "interference fringes" which appear superposed on the regular diffraction image of the star. When the apertures are close together the "visibility" of the fringes is said to be 100 per cent. As the apertures are separated the visibility is reduced, the fringes become weaker and at a still further separation they vanish. The relation, $\alpha = 1.22\,\lambda/b$ existing between the angular diameter of a star, the effective wave length of its light and the distance apart of the two outer mirrors when the fringes vanish enables one to determine the star's angular diameter. The linear diameter of the star can then be calculated if its parallax is known. The interferometer attachment is described together with the method of operating it. It consists of a fabricated steel beam 21 feet long, carrying four 6-inch mirrors, inclined at 45°, the two inner ones being fixed and faced downwards, the two outer adjustable and facing upwards. It is placed on the end of the telescope and observations made at the Cassegrain focus, which has an equivalent focal length of 134 feet. An auxiliary optical device, consisting of a movable wedge of glass and a plane parallel compensator enables the observer to equalize the two pencils of light and obtain the desired fringes. Two additional pencils passing over the ordinary path in the telescope, form a comparison image with "zero" fringes superposed; both interferometer and comparison images are viewed simultaneously with an eyepiece. When the seeing is poor it is difficult to be certain that the fringes have actually vanished; a weakening of the zero fringes, however, at the same time furnishes the observer with a check in the matter.

On December 13, 1920, the interferometer fringes vanished for α Orionis when the distance between the mirrors was about ten feet. The seeing was good and the instrument adjustments were verified on check stars both before and after the observation. Assuming a wave-length of 5.75×10^{-5} cm. the approximate angular diameter is 0″.047. Using a value of 0″.020 for the parallax, the linear diameter is roughly 218,000,000 miles.

Definite decrease in visibility of the fringes has been observed by the writer with the 20 foot interferometer, for α Tauri, α Bootis, α Scorpii and β Geminorum. The diameter of β Geminorum is smaller than can be measured with this interferometer. Additional observations will be necessary to definitely determine the diameter of the others. The work will be continued until all the brighter stars have been examined.

Atomic theory and ideal numbers: LEONARD EUGENE DICKSON. On the basis of close analogies with the molecular and atomic theories, it is possible to give a clear insight into the nature of ideal numbers, which play such an important rôle in the mathematical world to-day. This special importance is due to the fact that only after the introduction of ideal numbers do the laws of divisibility, valid in arithmetic, hold also for algebraic numbers. Without ideal numbers the situation in regard to algebraic numbers is most chaotic. The restoration of order out of chaos by the invention of ideal numbers is one of the chief mathematical triumphs of our century.

A general catalog of stellar distances: FRANK SCHLESINGER. This paper deals with a review of the various methods for determining stellar distances and describes the methods that have been employed to mold the observations into a homogeneous whole.

Intermittent vision at low intensities: HERBERT E. IVES. An experimental study of the phenomena of flicker at low intensities where twilight or rod vision prevails. Blue light was used, reduced in intensity until all sensation of color disappeared. Under these conditions the speed of alternation of light and dark at which flicker disappears, becomes independent of changes of intensity, unlike its behavior at high intensities where it increases or decreases as the intensity is raised or lowered. The

principal object of the study was to find the effect on flicker of various "wave-forms" of light distribution throughout the intermittent cycle. Rotating discs were used, cut to various simple shapes and openings, and rotated in such relation to a light source that the illumination of the observing target could be interrupted gradually, abruptly, partially, or for varied fractions of the total cycle or period of intermittence. The speeds were found at which the sensation of flicker disappeared ("critical speeds"). These vary in a systematic manner with the change of wave-form, but in a different manner from their course at high intensities. A strikingly simple mathematical expression has been found to represent the critical speed-wave-form data. If the wave-form is represented by its expansion in a Fourier series, the critical speed is directly proportional to the logarithm of the coefficient of the first periodic term of the expansion, divided by the average value.

The effect of tension on the electrical resistance of some of the more unusual metals: P. W. BRIDGMAN. In this investigation those metals have been examined which are abnormal in that their electrical resistance increases under hydrostatic pressure. It is normal for the resistance of a metal to increase under tension. The point at issue was whether the metals which are abnormal in their pressure coefficients would also be abnormal in their tension coefficients. Five metals are known whose pressure coefficients of resistance are abnormal; these are bismuth, antimony, lithium, calcium, and strontium. It was found in this investigation that the tension coefficients of only two of these, namely bismuth and strontium, are abnormal, whereas that of the other three are normal in that the resistance increases under tension. Taken in conjunction with the view of the nature of metallic resistance which I have developed recently elsewhere, these facts are taken to indicate that the mechanism of conduction in lithium is by a passage of electrons between the atoms, whereas in bismuth the conduction is mainly by the passage of electrons through the atoms. In strontium it is probable that both types of conduction are present, in calcium that the conduction is mainly of the first type, and in antimony mainly of the second. The alloys manganin and "therlo," whose pressure coefficients are abnormal, have also been investigated, and their tension coefficients found to be normal. This is also in accord with the theory.

The conductivity of mixtures of nitrogen and chlorine in a flaming arc: W. A. NOYES. For about seven years the author of the paper and his assistants have attempted to secure the direct combination of nitrogen and chlorine by methods similar to those which are used in the preparation of the oxides of nitrogen by the use of the electric discharge. Some of the early experiments seem to indicate that nitrogen and chlorine combine in the electric arc, but after a very careful elimination of every trace of oxygen and of moisture from the apparatus no combination could be established. Less than 0.3 of a milligram of combined nitrogen was found in an experiment which was conducted for 51 hours. When air was subjected to the same conditions several grams of the combined nitrogen were obtained.

Rose Atoll, Samoa, in its relation to recent change in sea level: ALFRED G. MAYOR. This rarely visited atoll proves to be composed of lithothamnion rather than coral. The atoll rim was once about 8 feet higher than at present, and has been cut down nearly to present sea level after the ocean subsided to this extent in recent times. The extreme isolation of the atoll is shown by the fact that there are only three species of plants upon the island; a *Pisonia* forming a beautiful grove of trees, a small yellow-flowered *Portulaca*, and a creeping pink-flowered *Boerhaavea*. A rat allied to a Malayan form, and widely distributed over Polynesia is the only mammal on the island. It is interesting to see that all the islands of American Samoa indicate that the sea was once at least 8 feet higher than at present, and Rose Atoll leads us to infer that the climate was tropical when the sea level was highest, for fossil corals and lithothamnion are found in the atoll rim above present sea level.

"Turtle Oreodon Layer" or "Red Layer," a contribution to the stratigraphy of the White River oligocene (results of the Princeton University 1920 expedition to South Dakota: W. J. SINCLAIR. This paper describes the lowest member of the Oreodon beds in the Big Badlands of South Dakota, a pinkish gray clay with several zones of rusty nodules at its top. Although it has supplied abundant fossil bones to collectors for over seventy years, very little has been published about it, and the present paper endeavors to give some details regarding its nature, the origin of the sediments, conditions under which they were laid down and so on, and to tie up certain of the changes both in sediments and faunas to a climatic factor. The first fresh-water algal limestones to be identified in any of our continental tertiary formations are described.