ABSTRACTS FROM ASTRONOMICAL PUBLICATIONS.

In accordance with a recent arrangement the members of the scientific staff of the Lick Observatory hold meetings once per week, as an observatory duty, to report upon and discuss the more important articles appearing in the journals of astronomy, the important new books on astronomical subjects, or subjects of current and special interest in the observatory's work. It has been suggested that abstracts of the reports would be of interest to the readers of these Publications, and the Publication Committee has acted favorably upon the suggestion.

It is intended to preserve the qualities of abstracts as far as possible, and to restrict published criticisms, favorable or unfavorable, to a minimum.

A New Form of Interferometer.

In the October number of the *Zeitschrift für Instrumentenkunde* Dr. F. Goos describes a new, simple and inexpensive form of the Fabry-Perot interferometer. In the usual form of this instrument the device for securing parallelism of the half-silvered plates is rather complex, and the instrument is very sensitive to vibration, so that an isolated pier is necessary. These precautions are not necessary with the improved form, which is a rigid whole. The glass plates are carried in a horizontal instead of in a vertical position. The base, carrying the lower plate, is a massive three-legged spider, the three feet being at the vertices of an equilateral triangle about ten inches on a side. Three fairly good micrometer screws, of half-millimeter pitch, screw into the three feet; on these screws rests the upper plate carrier. The screws are provided with large divided heads; these are divided into one hundred parts, and a movement of one division changes the parallelism of the plates by 4″.5 of arc. Finer screws or larger spiders would give still greater sensitiveness. The instrument is easy to adjust, vibrations have very little effect, and it would be easy of construction with the facilities of an ordinary laboratory.

H. D. C.

On the Staining of Photographic Plates.

The methods of staining photographic plates introduced by Professor Wallace, by enabling astronomers and physicists to photograph the red end of the spectrum without difficulty, have caused great advances to be made in certain lines of astro-

physical work. Where relative intensities are desired, however, it seems that the method must be used with great care. This aspect of the subject is dealt with in a suggestive paper by Professor V. M. ARCICHOVSKY, in Vol. I, No. 17, of the *Ann. de l'Inst. Polyt. à Nowocherkassk.* The paper is entitled "On the Search for Chlorophyll on the Planets," and is in Russian, with a résumé in German at the end. A number of investigators have considered the possibility of deriving, by spectrographic means, evidence as to the existence on the planets of Chlorophyll, so characteristic of terrestrial vegetation. With this phase of the subject the present paper has very little to do; it is rather a study of the staining methods used for sensitizing plates to the red rays. A large number of tests of the effects of pinacyanol, pinaverdol, and dicyanin were made with short exposures; some were made on the Sun and others on a Welsbach burner. The effect of the various dyes was determined separately, and also in various combinations; in particular, a number of tests were made using the same dyes and the same manipulation as used by SLIPHER in securing his well-known spectrograms of *Uranus* and *Neptune.* The sensitiveness of plates stained with any or all of these dyes is quite irregular, absorption bands showing clearly with short exposures. ARCICHOVSKY comes to the conclusion that SLIPHER'S results on *Uranus* are really a combination of the planet spectrum with those effects due to the irregular sensitiveness of the plate stained by his method. The cuts show quite conclusively that the dark band between B and C, in particular, in SLIPHER'S spectrum of *Uranus* can be secured in spectrograms of the Sun or the Welsbach burner on plates stained in this way. While not all of the bands in the spectrum of *Uranus* can be thus reproduced, Professor ARCICHOVSKY'S results are suggestive and valuable, and emphasize the need for further studies in this field before complete confidence can be felt in investigations involving short exposures on plates stained for sensitiveness in the red end of the spectrum. H. D. C.

A CONTRIBUTION TO OUR KNOWLEDGE OF STELLAR DISTANCES.

Parts III and IV of Volume II of the *Transactions of the Astronomical Observatory of Yale Observatory* have just been

published and form a fitting continuation of the valuable work which has been carried on at this institution in the determination of stellar distances by means of the heliometer. Determinations of the parallax of forty-one southern stars north of — 13° declination and a catalogue of all parallax determinations made at Yale are included in the volume.

The stars selected were, for the most part, those of large proper motion. The average probable error is ± 0″.017. This is very small and stamps this series as more accurate than any other extended list of heliometer determinations. It should be noted here that this average probable error is almost as small as that of the very best modern photographic parallaxes, for it is but very little larger than the average probable error of ± 0″.013 secured by SCHLESINGER. If this record could be maintained, the heliometer would take its place as fully the equal of the best photographic determinations with long-focus instruments. For all the Yale heliometer results the probable error in 245 determinations averages ± 0.″030, while the average of a large number of old and modern heliometer determinations is ± 0″.035.

Three stars in this list have large parallaxes. These are ε *Eridani,* 0″.31; δ *Eridani,* 0″.18, and *Weisse* 16^{h} 906, 0″.21, placing these stars in the list of our nearer stellar neighbors. Of the forty-one stars, ten, or nearly one-fourth, show negative parallaxes (three of these, it is true, being bright stars without sensible proper motion included in the list). Modern ideas of the stellar universe premise a scale of distances far more vast than was held twenty years ago, and this proportion of negative parallaxes tends to inspire a feeling of confidence in the Yale results rather than otherwise. That so excellent a series, based upon stars of large proper motion most likely, *a priori,* to be among our nearer neighbors, should show this proportion of negative parallaxes, brings home to us, however, the insurmountable character of the wall which bars our progress. It is becoming increasingly more evident that the best modern methods, whether heliometer or long-focus photographs, can do little more than to pick out some of our nearer neighbors. A combination of radial velocity and proper-motion data has already given us trustworthy results for the average distances

of the brighter stars several times more remote in space than the limit given by the direct methods. The radial velocity method will undoubtedly extend our measurable universe still farther in the next half-century, but even in this method we can discern the barrier ahead beyond which we cannot pass, for the era of position observations on the fainter stars is too short to determine accurately their minute proper motions, and the radial velocities are too difficult to secure. What will be the new methods of determining the size of our universe, or will the present barriers always stand? H. D. C.

A Possible Absorption of Gravitational Energy.

One of the most interesting subjects discussed in recent astronomical literature is that of a possible absorption of gravitation by a body situated or passing between the two bodies whose mutual attractions are in question. Important papers have been published by Dr. K. F. Bottlinger, in a preliminary way in the *Astronomische Nachrichten* of April 21, 1912, and more completely a little later as a prize dissertation of the University of Munich, in pamphlet form; and likewise by Professor de Sitter in the November number of *The Observatory*. Professor de Sitter recalls attention to the remarkable fact that thus far no satisfactory physical explanation has been found for the existence or nature of gravitation. He quotes from his paper dated 1908 to the effect that the explanation must be sought "in its extreme simplicity, its complete independence of everything that affects other phenomena of nature. Gravitation is not subject to absorption nor refraction, no velocity of propagation has been ascertained, it affects all bodies equally without any difference, always and everywhere we find it in the same simple and rigorous form, which defeats all attempts to penetrate into its inner mechanism."

In 1909 Professor Seeliger proposed a new point of view concerning gravitational attraction, as follows (a free translation): "The entering of a third body between two other bodies must influence the normal attraction of the two bodies upon each other and show departures from the Newtonian formula, which one may perhaps describe as absorption of

gravitation. Such departures, which in themselves seem quite plausible, have perhaps first to establish themselves by discovery. They may eventually be discoverable in the motion of the Moon—and perhaps only in the lunar motion."

Shortly thereafter BOTTLINGER, a student of SEELIGER'S, undertook the investigation of the question whether the gravitational pull exerted by the Sun upon the Moon is during a lunar eclipse diminished by a small fraction of its amount, dependent upon the mass of the Earth which is traversed, so to speak, by the lines of solar gravitational force which would reach the Moon. As a starting-point, BOTTLINGER assumed that the interposition of the Earth would reduce the effective solar attraction upon the Moon by a function of the Earth-mass traversed, and computed the variations in lunar longitude which should have resulted in consequence of the lunar eclipses from 1834 to 1909.

Almost simultaneously and before BOTTLINGER'S results were published, DE SITTER had carried through similar investigations and computations. The results of the two investigators are not in strict accord, though their curves of longitude disturbances have many points in resemblance. Both investigators were interested to determine whether the unexplained discrepancies between observed and predicted longitudes of the Moon, as published by Professor NEWCOMB, could have their explanation in this absorption of gravitational force. In brief, the discrepancies announced by NEWCOMB are not satisfactorily explained on this basis; but on account of the computational difficulties, and of uncertainties as to the form of the absorptive function and the distribution of mass within the Earth, no one can safely say that the absorption of gravitation during lunar eclipses is not the important factor. We can only say that the problem remains as yet unsolved, because of the difficulties and uncertainties inherent in its nature.

W. W. CAMPBELL.

NOTES ON THE PROBLEM OF LATITUDE VARIATION.

Nature for December 26, 1912, abstracts an interesting and instructive article on the relationship of latitude variations and mean sea-level variations in Japan, as published in the Japan

Astronomical Herald by Dr. OMORI, the seismologist. Studying the mean sea-level records for nine stations on the Japanese coast, he finds that average sea-level was low in 1897 and 1902, but was high in 1899 and 1905. The greatest fluctuations seem to have occurred at Misaki, near Yokohama, where the mean sea-level, constant in 1897, was 166 millimeters higher by 1909. Plotting the mean results for the nine stations, and likewise the latitude variations as observed at Tokyo and Mizusawa during the same period, OMORI observed that the curves for the two phenomena have striking resemblances, from which it appears that a variation of 0″.1 in latitude was accompanied by the change of 42 millimeters in sea-level. These results are very suggestive of promising investigations along the same lines, based upon voluminous existing records of mean sea-level at many coastal points throughout the civilized world.

The *Comptes Rendus* of the Paris Academy of Sciences for October 14, 1912, publishes an interesting account of the Hamburg meeting of the International Geodetic Conference last September. We note with regret that a shortage of financial resources makes it necessary to reduce the number of International Latitude stations. The high efficiency shown in the administration of this special latitude service and the fruitfulness of the results bring instant regrets that a curtailment of the service is even considered. The account does not state which stations are to be closed, but I learn from another source that the station at Gaithersburg, Md., has been instructed to bring its work to a conclusion in the immediate future.

Dr. F. E. Ross, who has been the Gaithersburg observer for several years past, has recently made an important contribution to the latitude variation question, notwithstanding that his conclusion is of a negative character. The so-called Kimura term in the latitude variation has seemed to imply that the effective center of mass of the Earth shifted northward from its mean position to the extent of three or four feet every northern winter season and correspondingly southward from its mean position three or four feet every southern winter season. Dr. Ross's thorough-going paper on the subject lends strong support to his belief that the insufficiency of the formulæ upon which the computations have been based is responsible for the

greater part of the apparent Kimura annual variation. I understand Dr. Ross's point of view to be that the entire term may be due to this cause, and that the Kimura variation may have no objective existence. W. W. CAMPBELL.

CONTRIBUTIONS TO THE LABORATORY SPECTRUM OF HYDROGEN.

Nature for December 26, 1912, describes briefly some extremely important results on the hydrogen spectrum secured by Professor ALFRED FOWLER of South Kensington.

Taking up the subject chonologically, we begin naturally with the Harvard College Observatory's announcement in 1896 that a new series of absorption lines, six in number, had been found in the spectrum of *Zeta Puppis,* which are apparently in intimate relationship with the well-known lines in the spectrum of hydrogen. Later spectrograms of the same star brought the number of lines in the new series up to eight, in 1897. Professor PICKERING was able to construct a formula of relationship between wave-lengths and a variable, *n,* such that by substituting successive integral numbers for *n* the resulting values of the wave-lengths were those of all the lines in the well-known hydrogen spectrum and of all the lines in the new series. He therefore concluded that the newly found lines belong to the spectrum of hydrogen. Further interesting questions as to the relationship of the old and new lines were discussed by KAYSER and by RYDBERG, but upon these we need not comment here except to say that RYDBERG's formula predicted the existence of additional hydrogen lines at wave-lengths 4688, 2735, 2386, 2254 and 2188.

FOWLER'S recent study was of the spectrum obtained by passing a strong electric discharge through an ordinary Pflücker tube containing a mixture of hydrogen and helium. In particular, he observed lines at wave-lengths 4686, 2733, 2385 and 2253, which are unquestionably the first four of the five lines predicted by RYDBERG.

Other lines observed by FOWLER agree well with three lines which the Harvard College Observatory had found in the spectrum of *Zeta Puppis.*

Three other strong lines observed by FOWLER, at wave-

lengths 3203, 2511 and 2306, are said, according to the report, to belong to the hydrogen spectrum.

It is of especial interest to note that none of these ten lines were apparently observed by FOWLER except when he was dealing with hydrogen and helium combined; another illustration of the apparent principle, to which several observers have called attention, that the spectrum of an element may be affected by the presence of another element.

Such additions to our knowledge as that made by FOWLER frequently have applications to celestial spectroscopy so wide that one cannot foresee the limits. W. W. CAMPBELL.

GENERAL NOTES.

Death of Dr. Lewis Swift.—It is with great regret that we record here the death of this veteran astronomer on January 5th at his home in Marathon, New York. Dr. SWIFT lacked but a few weeks of being ninety-three years of age; he was born at Clarkson, New York, on February 29, 1820. As an astronomer and scientist, Dr. SWIFT was largely self-educated. When a young man he became greatly interested in scientific matters, and devoted himself for some time to the lecture field, traveling about and lecturing upon electricity, then a comparatively new subject. He afterwards entered the hardware business, but found time to continue his astronomical work at the same time, discovering several comets. Moving to Rochester, he set up his small telescope on the roof of an old cider mill, and his cometary discoveries attracted the attention of H. H. WARNER, a wealthy manufacturer of proprietary medicines. Mr. WARNER built for Dr. SWIFT the Warner Observatory, in which was installed an 18-inch refractor, whose cost was met by popular subscription by the citizens of Rochester. Financial reverses later compelled Mr. WARNER to withdraw his support, and Dr. SWIFT then took this telescope to the Lowe Observatory, in Southern California, where he remained till failing eyesight compelled him to withdraw from all astronomical work.

Dr. Swift discovered fourteen comets and over thirteen hundred new nebulæ, and it is from his work in these fields that his name is best known. He was one of the very few astronomers who have had the privilege of seeing Halley's Comet at two successive apparitions. He was a Fellow of the Royal Astronomical Society, and was the recipient of numerous medals for his cometary discoveries. He was almost entirely deaf, but overcame this obstacle to his scientific work with characteristic ingennuity by placing a small induction coil in circuit with his clock, so that at each tick a slight shock was sent through his arm. His last years were spent in retirement from all active duties, at the home of his daughter in Marathon Though both hearing and sight had now failed him, he never ceased to manifest a keen interest in the progress of his favorite science.

Eclipses in 1913.—There will be three solar eclipses in 1913, but all of them will be partial eclipses and of no particular interest astronomically. These partial eclipses will take place on April 6th, August 31st, and September 29th. For the eclipse of April 6th, the eclipse area extends just south of San Francisco, but the amount of obscuration will be too slight to be noticed without telescopic aid. The other two will not be visible at all from the United States. There will be two total lunar eclipses. That of March 21st-22d will be visible in California, the middle of the eclipse coming a few minutes before 4 A. M. on the morning of the 22d. The beginning of the lunar eclipse of September 14th-15th will be visible in California, but not the total phase.

The trustees of Wesleyan University have voted to build an astronomical observatory at a cost of $60,000.—*Science,* November 15th.

The next meeting of the International Union for Solar Research will be held at Bonn, beginning August 1, 1913. The Astronomical and Astrophysical Society of America will hold no summer meeting in 1913, because of the probable absence of a number of its members at the Bonn conference. The summer meeting of 1914 will be held at Northwestern University, and that of 1915 in San Francisco and at the Lick Observatory.

The great 100-inch disk of glass for Mount Wilson was at first rejected because of flaws. After a number of attempts to secure a more perfect disk of the requisite thickness had failed, it was decided to make the attempt to figure and polish the disk on hand. We learn from *Popular Astronomy* that recent tests unfortunately show that this disk is probably useless, as was feared, and the completion of the great reflector seems therefore to be only a hope of the distant future, depending on the securing of a more perfect disk of glass. It is said that a perfect disk eight inches thick has been cast, but this is believed to be relatively too thin to promise a successful mirror. The casting and proper annealing of so great a disk appears to be fully as difficult a matter as in the case of great lenses.