A. M D. G.

BULLETIN

of the

American Association of Jesuit Scientists

(Eastern Section)

Astronomical Number

GEORGETOWN UNIVERSITY
WASHINGTON, D. C.

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EDITORS.

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Attingis Solem Proprius? Dum Lucis et Umbrae
  Naturam spondes hoc retulisse Libro.
Vix licet hoc superis: est haud mortale quod audes?
  Audet enim Phaeton, et sua fata videt.
Desine mirari, KIRCHERUS conscius artis
  Non est mortalis: dictur athanatos
Uraniae radiis Solem Kircherus Heros
  Attigit: hinc vivet nescia fama mori.

In principio libri "Lucis & Umbrae."


IHS
P. ATHANASIUS KIRCHERUS FULDENSIS E SOCIETATE IESU ANNO ÆTATIS LXII ANNO CIↃ IↃ C LXIV.
Faustèa vel Pictor, vel Vates dixerit, HIC EST;
Et vultum, et nomen terra scit Antipodum.
Jacobus Albanus Ghibbesius. M. D.
in Romæ Sapientia Eloq. Prof.

ATHANASIUS KIRCHER

Fr. Athanasius Kircher was born on the second day of May, 1602, at Geisa, a township on the northern bank of the Upper Rhone. The epithet of Fuldensis frequently appended to his name has reference to Fulda, the capital of his native country. His first contact with the Jesuits was as student at our college at Fulda. He was admitted into the Society at Paderborn on the second of October, 1618. His novitiate over with, he was sent to Cologne for his studies in philosophy and it was during this period that he gave evidence of special talent for the natural sciences and the classics. He was assigned to teach these branches during his regency at Coblentz and Heiligenstadt. In 1625 he entered upon the study of theology at Maintz and was ordained to the priesthood in 1628. His third year of probation was made at Spyer, in southern Germany, and thereupon he was appointed to the chair of ethics and mathematics at the University of Wuertzburg. Following the invasion of the Swedes into Germany he was forced to retire to France in the year 1631. Through the influence of Cardinal Barberini he was summoned to Rome in 1635 to fill the chair of physics and mathematics and oriental languages at the Roman College. After six years he was relieved of this professorial work in order that he might devote himself exclusively to research. Forty-three folio volumes mark his contributions to the world's literature. We shall content ourselves in indicating some of the more notable of these writings. These are: *Ars Magnesia* (1631); *Magnes, sive de arte magnetica opus tripartitum* (1640); *Prodomus coptus sive aegyptiacus* (1636); *Lingua Aegyptiaca restituta* (1643); *Obliscus Pamphilius* (1650); *Oedipus Aegyptiacus, hoc est universalis doctrinae hieroglyphicus instauratio* (1652-1655); *Ars magna lucis et umbrae* (1646); *China Illustrata* (1667); *Musurgia universalis, sive ars magna consoni et dissoni* (1650); *Polygraphia seu artificium linguarum quo cum omnibus mundi populis quis respondere, etc.* (1663); *Mundus subterraneous, etc.* (1678); *Ars Magna Sciendi* (1669); *Latium* (1669). In his *Specula Melitensis Encyclica,* Kircher files his claim to being the first to assemble a calculating machine and in the *Ars magna lucis et umbrae* we find the first description of the Magic Lantern, an instrument which after many improvements has today eventuated in our moving picture machine.

Fr. Kircher's activities reached out into every angle of science and literature. He was a mathematician, physicist, biologist, optician, musician, virtuoso, Orientologist and a classicist. Besides, and this seems most strange, he was a medical man. Of him, Dr. Fielding H. Garrison writes in his world-wide known *Introduction to the History of Medicine:* "The earliest of the microscopists was the learned Jesuit priest, Athanasius Kircher." In his *Scrutinium pestis* (Rome, 1658) he not only details seven experiments upon the nature of putrefaction, showing how maggots and other living creatures are developed in decaying matter, but found that the blood of plague patients was filled with a countless brood of "worms," not perceptible to the naked eye, but to be seen in all putrifying matter through the microscope. While Kircher's "worms," as Friedrich Loeffler claimed, were probably nothing more than pus-cells and rouleaux of red blood corpuscles, since he could not possibly have seen the bacillus pestis with a 32-power microscope, yet it is quite within the range of possibility for him to have seen the larger microörganisms, and he was undoubtedly the first to state in explicit terms the doctrine of a "contagium animatum" as the cause of infectious disease. Besides, in his *Physiologia Kircheriana,* he was also the first to record an experiment in hypnotism. Fr. Kircher died at Rome on November 28th, 1680. Fittingly has his likeness, appearing on the frontispage, been inscribed by Jacobus Albanus Ghibbesim, M.D., in Rom: Sapientia Eloq. Prof.:

> Frustra vel Pictor vel Vates dixerit, His est:
> Et vultum, et nomen terra scit Antipodum.

Francis A. Tondorf, S.J.,
Georgetown University,
Washington, D. C.

LONGITUDE OF GEORGETOWN COLLEGE OBSERVATORY AS DETERMINED DURING WORLD LONGITUDE OPERATION

During October and November, 1926, the Georgetown College Observatory took part in the World Longitude Operations for the twofold purpose of securing a more precise determination of its own longitude and of contributing one more link in the worldwide chain of secondary longitude stations. In the following pages, after a short historical survey of the previous determinations of the longitude of the Observatory, there will be given an outline of the methods employed in the present determination and the results thereby secured.

PREVIOUS DETERMINATION OF LONGITUDE

Before 1926 there was, as far as the records show, only one determination of the astronomical longitude of the observatory. This was made in 1846, three years after the foundation of the observatory, by Father James Curley, S.J., the first director. A detailed account of this determination is given in the *Annals of the Georgetown College Observatory,* Vol. I, pp. 157, and foll. The method used was that of observations of the *Moon* and *Moon*-culminating stars, at Greenwich and at Georgetown. There were four satisfactory sets of observations made between February and October, 1846, giving as the deduced longitude $5^h\ 8^m\ 18^s.15$. The average deviation of the individual observations from the mean was $1^s.09$. "In order to connect Georgetown with the (Old) Naval Observatory in Washington, Fr. Curley determined the distance between the Georgetown dome and the Naval Observatory by triangulation, using for his base-line the old bridge spanning the Potomac River between Georgetown and Rosslyn, Virginia, and found that Georgetown was $6^s.20$ west of the Naval Observatory. This result was published in the *Astronomical Journal,* Vol. I, p. 70 (May, 1850), and upon it is based the longitude of Georgetown as given in the *American Ephemeris and Nautical Almanac* from 1855, certainly up to 1898 and most probably up to 1900.

The different values of the Georgetown longitude from Greenwich given in the volumes of the *Ephemeris* during the years above referred to, are due to the various adopted values of the longitude of the Naval Observatory, to which the constant $6^s.20$ was added to derive the longitude of Georgetown. The resulting published longitude varied between $5^h\ 8^m\ 17^s.40$ and $5^h\ 8^m\ 18^s.29$, while the direct determination by Fr. Curley yielded $5^h\ 8^m\ 18^s.15$.

In 1901 a new basis was adopted by the *Ephemeris*. This was deduced from the longitude differences, as measured geodetically by the U. S. Coast and Geodetic Survey, between the College Observatory and both the old and New Naval Observatory sites. Since the topographic deflection from the vertical varies considerably at different points in the neighborhood of Washington, the variation in the difference between the geodetic and astronomical determinations of places is also considerable, amounting in some cases to as much as 2 or 3 seconds of arc. Hence the value $5^h\ 8^m\ 18^s.28$, deduced geodetically, cannot be considered as giving a precise astronomical longitude.

The following note (in Father Curley's handwriting) found in the library copy of the *Ephemeris* for 1867 is of interest as bearing on the actual, even though partly fortuitous, accuracy of Father Curley's work. It reads: "By the Georgetown observations Washington (*i. e.*, the Old Naval Observatory) is $77^\circ\ 3'\ 00''$ from Greenwich." This differs considerably from the value then published in the *Ephemeris*, $77^\circ\ 4'\ 21''.0$, but agrees almost exactly with the value $77^\circ\ 3'\ 0''.6$ finally adopted in the *Washington Observations* (cf. vol. for 1892, published in 1899, p. XIV). This final value was "deduced by the U. S. Coast and Geodetic Survey from a general adjustment of telegraphic determinations of differences of longitude made between the years 1846 and 1885." The *Washington Observations* gives as reference the "*Report of the Superintendent, United States Coast and Geodetic Survey*, 1884, Appendix II, p. 423." The geodetic difference between Georgetown and Washington there given is $6^s.196$, which confirms the value $6^s.20$ adopted by Fr. Curley in 1846.

1926 DETERMINATION

I. Equipment

1. The Clock used throughout the period of the observations was the sidereal Riefler Clock No. 36. As there was no clock vault, it was not possible to keep the clock at constant temperature and pressure. However, the clock was in a double glass case consisting of the usual constant pressure case and an outer case attached to the pier supporting the clock. This pier is the lower portion of the massive masonry pier that extends from the ground to the dome of the 12″ equatorial. The clock was sealed and the pressure reduced, and the room protected from sudden changes in temperature. The temperature and pressure were recorded whenever the radio time signals were received and a self-recording thermometer was also kept in the outer case. These readings were used to assist in obtaining the clock correction curve, as will be indicated below. The toothed wheel causing the breaks of the Riefler circuit has 19 teeth. Thus the breaks are three seconds apart excepting at the end of the minute, the 57th second being omitted.

2. The transit instrument was the 4½″ Ertel transit of the Observatory. It was not equipped with an impersonal micrometer and the observations were made with the ordinary transit key. The personal equation of the observer was determined by means of the personal equation machine in connection with the 9″ transit circle of the U. S. Naval Observatory. For the courtesy and help extended to the observer by Mr. H. R. Morgan, in this regard, grateful acknowledgmement is here made.

3. The chronograph was a Fauth cylinder chronograph with one pen, which recorded all the signals. The clock signals, as has been stated, are spaced three seconds apart, and as they were made quite short there were very few cases of coincidence between the clock signals and the transit signals. As to the time signals there were always a sufficient number of non-coincident signals to allow a good set of readings to be obtained from each station recorded.

4. The wireless receiving and recording apparatus was a very simple but effective three-tube set built along lines suggested by Mr. Sollenberger of the Time Service Department, U. S. Naval

Observatory. The plate current of the second amplifier tube was sent through the primary circuit of a sensitive telegraph relay and the chonograph and the clock were placed in the secondary circuit. All the circuits excepting the primary of the relay were break circuits. The relay would respond to a current of a little over one-half a miliampere and the average available plate current of the radio set was 3 miliamperes. The lag of the entire radio relay system was determined by means of a low-power local sending set, so that the over-all station lag could be deducted from the recorded times of the radio signals.

II. Personnel

All the observations were made by the Director, who at that time did not have an assistant. In the reading of the records and the reduction and discussion of the observations he was assisted by Rev. Paul A. McNally, S.J., and Mr. Thomas D. Barry, S.J., who joined the staff at a later date.

III. Method of Observation and Reduction

1. All the star places are those of the *Eichelberger Catalogue.** The apparent places were interpolated from the *American Ephemeris,* excepting for the two stars, ν and ψ *Peg.,* which were taken from the *Connaissance des Temps.* The corrections necessary to reduce the mean places given in the *Ephemeris* to the Eichelberger system were taken from the 1927 edition of the *Ephemeris.* In the interpolation of the apparent places second differences were used and the terms due to short period variations in nutation were applied.

2. The time sets generally consisted of from six to eight clock stars, transiting within 20° of the zenith, observed before the 10:00 P. M. and 10:15 P. M. (3^h and $3^h.15$ U. T.) signals of Annapolis, and the same number observed after the signals, with the telescope reversed in position. Several circumpolar stars were included to determine the azimuth constant. However, in order to avoid any notable effect on the clock corrections due to possible faulty values of the azimuth the clock stars were so chosen that the algebraic sums of their azimuth factors were in all cases very small.

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* *Astronomical Papers of the American Ephemeris, Nautical Almanac,* vol. X, part I.

3. The level and collimation constants were determined throughout the observations by means of the mercury nadir collimator and, as the telescope was reversed in the middle of each complete set of transits, the mean clock correction thus secured was practically free from the effect of any residual collimation error and inequality of the pivots. The measures made with the spirit level to test the pivots showed that the inequality was very small, and no correction for it was applied to the individual observations. There was found, however, a fairly large clamp term. For this reason, only those clock corrections were given full weight which were determined by complete sets of transits as outlined above. The few sets of clock stars observed in a single position of the instrument were reduced by means of the average clamp term and the resulting clock correction given half weight. The individual transits were reduced by Mayer's formula, the diurnal abberration being included in the collimation.

4. The readings of the chronograph sheets were made with a special scale divided to tenths of a second. All the records, both of star transits and time signals, were read by estimation to hundredths of a second. The length of one second of the chronograph sheet is closely one centimeter. For the star transits seven wires were used, and for the time signals at least ten signals were read and frequently a larger number.

5. The time signals received from Annapolis (NSS) were of two kinds: The American type at 3^h and 17^h U. T. and the Rhythmic type at $3^h.15$ and $20^h.15$ U. T. The method used in reading the signals was the same for both types and consisted in measuring on the chronograph sheet the distance from a clock signal to the adjacent time signal. The readings of the individual signals were generally reduced to the time of the last signal and the mean, of the signals thus reduced, taken. Sometimes, however, the mean of the individual signals was taken and the resulting mean reduced to the last signal. The method of coincidences was not employed.

6. The signals from Bordeaux (LY) were quite loud enough to be heard, but the limited power of the amplifier set was not sufficient for their automatic registration. The signals sent out

at $20^h.06$ U. T. from Bordeaux were regularly recorded by hand, and an effort made to determine the tap lag, but the results were not used in determining the adopted value of the longitude.

7. The mean clock corrections for each of the days on which a sufficiently complete set of transits was secured were first reduced to a common epoch by application of the mean rate of the clock for the entire period (Oct. 14—Nov. 30) and then plotted on coordinate paper. Next a curve was drawn to represent the variation in clock correction due to variable temperature and pressure. Finally a free-hand curve was drawn, so as to fulfill as nearly as possible the two conditions of passage through the plotted clock corrections and agreement in form with the temperature and pressure rate curve. The clock corrections to be used in connection with the individual time signals were then read from this curve and reduced to the epoch of the signals by a reverse application of the mean clock rate. In forming the mean value of the longitude the individual values for nights on which transit observations were secured were given weight 4. Values deduced from radio signals separated from transit observations by 12 to 60 hours, were given weights from 3 to 1.

RESULTS—LONGITUDE DIFFERENCES

					(1)	(2)
Georgetown College Obs.—Washington	0	0 2.390 ± .0026	5	8	18.143	18.141
Georgetown College Obs.—Greenwich	5	8 18.145 ± .0041			.145	.145
Georgetown College Obs.—Paris	5	17 39.061 ± .0044			.146	.145
Georgetown College Obs.—Algiers	5	20 26.668 ± .0038			.141	.143
San Diego—Georgetown Col. Obs.	2	40 30.244 ± .0036			.144	.143

(1) Reduction using λ's submitted at Leiden.

(2) Reduction using λ's as given in article published by Naval Observatory.*

A factor $0^s.018$ reduces the longitude of the transit instrument to the center of the G. C. O. dome. Longitude of G. C. O. dome 5^h 8^m $18^s.125 \pm .0010$.

* *Astronomical Journal* No. 908, p. 188.

E. C. Phillips, S. J.,
Contributed by Paul A. McNally, S.J.,
Georgetown University,
Washington, D. C.

THE LEONID METEORS

An appeal recently sent out by Willard J. Fisher of Harvard Observatory may interest some of our astronomers and lead them to examine the Jesuit Relations and other sources for references to the Leonid Meteors. We print the appeal and appended to it will be found a description of the meteors described in the Jesuit Relations as seen in the year 1663. Without a doubt these are Leonid Meteors, since they make their appearance every 34 years, and as can be seen from the dates published in the appeal, the year 1663 would be the time they ought to have appeared.

APPEAL FOR HISTORICAL RESEARCHES ON THE LEONID METEORS, AND OTHERS

Reports now in hand from observers in the United States indicate that the Leonid meteors have begun again in what should be their thirty-first reappearance since A. D. 902, "the year of the stars." Of these apparitions we have records of only fifteen; and of these fifteen, only the last four great maxima have been observed by men of modern scientific training, in 1799, 1833, 1867 and 1901. It is remarkable that in each of these well-observed cases the most intense showers were observed either in northern South America or in southern North America, and at intervals of thirty-four years, exact to two days. With regard to all the others we are uncertain whether the records refer to maxima or to showers before or after the maxima. The uncertainties can never be relieved without additional information, which may still exist, buried in archives or in unfamiliar tomes.

Much was done, in the early and middle decades of the nineteenth century, to discover records of observations of these and other meteors, by Chladni and his successors, and by Herrick, Chasles, Perrey, and E. Biot, to say nothing of the great catalogues of Quetelet. As regards the Leonids, the old evidence summarized by H. A. Newton, in the *American Journal of Science,* 1864, has hardly been augmented in the sixty-four years since.

But it is obvious that many sources of information have not been searched. Such are, the records of Indian and perhaps Egyptian literature, the *Relations of the Jesuit Missionaries to Canada,* other reports, civil and military, from the French possessions to the home government, and of all sorts from Spanish America, Brazil and the Philippines to the Church authorities and to the governments in Madrid and Lisbon. Probably also the logs of shipping and the records of merchants contain references to meteors, and, among them, to the Leonids. Perhaps the investigators of Mayan astronomy may be able to add to these. Japanese literature is untouched; and it is hard to believe that Chinese literature is finished.

We suggest that persons who have access to such records, or who are conversant with their contents, should either publish quite fully, and as soon as convenient, catalogues of ancient meteor observations, or should send copies in manuscript to persons or institutions able to make good use of them.

An understanding of the calendars involved is the only astronomical knowledge necessary for such historical research.

The dates related to Leonid showers are likely to be found about the beginning of each century, and about one-third and two-thirds through each century; for several hundred years back they have been in the early part of November. Research may discover references to the well-known showers in works not now known to contain such; and others of earlier date may be found, in the Renaissance and the Middle Ages. Especially valuable would be information about the reported shower of 1766.

The compliance of scholars with this request would be a distinct service to science.

WILLARD J. FISHER,
Harvard College Observatory.

NOTE ON THE LITERATURE OF ANCIENT METEORS

In a footnote to his paper on November star showers, *Am. Jour. Sci.* (2) 37, p. 378, 1864, H. A. Newton says of the sources of meteors:

"Mr. Quetelet has published three catalogues, two in the *Mémoires de l'Acad. Roy. de Bruxelles,* and a third in his

Physique du Globe. Mr. Herrick published one in *this Journal,* xl, 349. Mr. Chasles communicated one to the Academy of Sciences at Paris, published in the *Comptes Rendus,* xii, 499. Mr. Perrey added many citations from the chroniclers, *Compt. Rend.,* xiv, 19. Mr. E. Biot presented to the same Academy a Catalogue Général des Étoiles Filantes et d'autres Météores observés en Chine, which was published in the tenth volume of the Memoirs of the Academy. There is a large catalogue in Arago's *Astronomie Populaire,* iv, 292-345. It is entirely a compilation from the others."

Since 1864, additions to these data have been few and scattered.

RELATION OF WHAT OCCURRED IN THE MISSION OF THE FATHERS OF THE SOCIETY OF JESUS IN THE COUNTRY OF NEW FRANCE FROM THE SUMMER OF THE YEAR 1662 TO THE SUMMER OF THE YEAR 1663

Heaven and Earth have spoken to us many times during the past year and that in a language both kind and mysterious which threw us at the same time into fear and admiration. The Heavens began with Phenomena of great beauty and the earth followed with violent upheavals which made it very evident to us that these mute and brilliant aerial voices were not after all mere empty words since they presaged convulsions that were to make us shudder while making the earth tremble.

As early as last autumn we saw Fiery Serpents intertwined in the form of Caduceus and flying through mid-air borne on the wings of flame. Over Quebec we beheld a great ball of fire which illumined the night almost with the splendor of the day. The same meteor appeared over Montreal, but seemed to issue from the Moon's bosom with a noise like that of Cannon or Thunder; and after traveling three leagues in the air, it finally vanished behind the great Mountain whose name the island bears.

But what seemed to us most extraordinary was the appearance of three Suns. Toward 8 o'clock in the morning on a beautiful day last winter, a light and almost imperceptible mist arose from our great river and, when struck by the Sun's first rays, became transparent—retaining, however, sufficient substance to bear the two images cast upon it by that Luminary. These three Suns were almost in the same straight line, apparently several toises distant from one another, the real one in the middle and the others, on each side. All three were crowned by a rainbow, the colors of which were not definitely fixed; it now appeared Iris-hued, and now of a luminous white, as if an exceedingly strong light had been at a short distance underneath.

The spectacle was almost of 2 hours duration upon its first appearance, on the seventh of January, 1663; while upon the second, on the fourteenth of the same month, it did not last so long, but only until, the rainbow hues gradually fading away, the two suns at the sides also vanished, leaving the central one as it were victorious. *Jesuit Relations,* vol. 48, page 37.

JOHN L. GIPPRICH, S.J.,
Georgetown University,
Washington, D. C.

REDUCTION OF AN OCCULTATION

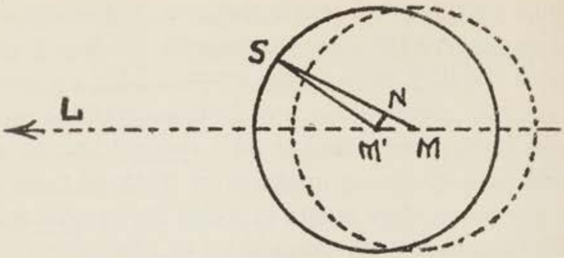
For most astronomical work elaborate equipment is necessary, but to observe the disappearance of the bright ephemeris stars behind the dark edge of the moon, noting the time to the nearest second, requires so few instruments that many can make these observations, and if they realized that in so doing they would be cooperating in the great work of correcting the tables of the moon, they would probably care to try their hand at it. The drawback is the preparation or prediction of the time of occultation, and the subsequent reduction of the observation. The predictions are given for Washington in the *American Ephemeris*, but for other places they are most readily predicated by the method of Father Rigge, or by some other graphical method. Father Rigge's book leaves little to be said on the matter of making predictions. The reduction of the observation is unnecessary because Professor Brown is so anxious to get the observations that he is prepared to have them reduced himself. On the other hand, in order to encourage observors to make their own reductions he has sent out computation forms and a model to go by. Using the form and following the model, the computation can be performed readily enough, but it is not at all obvious what the computation is all about.

I have been asked to explain the 68 steps in the reduction of an occultation. These steps are merely entries in a form for logarithmic computation and it seems better to explain the matter backwards, beginning with what is wanted and then explaining how the various items are to be obtained.

PURPOSE OF COMPUTATION

Occultations furnish valuable data concerning the apparent deviations of the moon from its gravitational orbit, since the observations are free from systematic errors, and other errors may be expected to average out. The observations of the disappearances of the ephemeris stars behind the dark edge of the moon are requested. The observed time of disappearance is sufficiently accurate if obtained to the nearest second of time

(A. J., vol. XXXVII, No. 876, page 99, Dec., 1926). Reduction of observations for the Western Hemisphere will be taken care of by Ernest W. Brown, Yale University Observatory (ibid.).



The deviation in question is almost wholly a question of a correction of the moon's longitude. If the figure M is the position of the center of the moon according to the ephemeris at the time of occultation and S is the position of the star, then to bring the star onto the edge of the moon, the center of the moon must be advanced from M to M^1. We have

$$\sigma = SM^1 = SN$$
$$\sigma^1 = SM$$
$$\sigma^1 - \sigma = NM$$
$$\text{angle } LMS = \chi - \varrho$$
$$\Delta v = M^1M = NM\sec LMS = (\sigma^1 - \sigma)\sec(X - \zeta).$$

To determine the value of Δv we therefore require the values of σ, σ^1, χ, and ζ. If many observations are available, the deviation perpendicular to the orbit may solved for by means of the equation

$$\sigma^1 - \sigma = \Delta v \cos(\chi - \varrho) + \Delta\beta \sin(\chi - \varrho)$$

The matter here is taken from the Astronomical Journal No. 835, vol. XXXV, p. 155, article by R. T. A. Innes, Sproul Observatory, Swarthmore, Pa., March 24, 1924.

NOTE ON SMALL ANGLES

The arc of 1° in a unit circle is .0174533 and the sine is .0174524, so that they are equal to five places of decimals. The square of this value is .000305 and the cube is .0000053. We have the expansions

$$\sin x = x - 1/6\, x^3 + = x(1 - 1/6\, x^2)$$
$$\cos x = 1 - 1/2\, x^2 +$$

If we decide on keeping 5 places of logarithms, we may identify arc and sine up to 40′, but from there up to about 9° we need the term involving the cube of the angle. We may call the cosine unity up to 16′ 30″, but we take the term involving the square of the angle to obtain five places correct up to about 6°.

The moon's parallax varies from 53′ to 61′ and so if five significant figures are required the term involving the cube must be applied.

$$0.16'' = 0.000\ 000\ 776 \text{ radians} = 1/6\, x^3$$
$$x = 0.0167 \text{ radians} = 57'\, 20''$$

This explains the correction applied in steps 13, 14, 15. Or in the neighborhood of 1° 1/6 the square of the angle in radians is 0.00005 = 1/2000 and we obtain the correction suggested by Innes

$$\sin\pi = \pi\ 1 - \frac{1}{20000}$$

THE MOON'S SEMIDIAMETER

The moon's geocentric semidiameter is the angle at the center of the earth subtended by the moon's radius, while the moon's horizontal equatorial parallax is the angle at the center of the moon subtended by the earth's equatorial radius. The ratio of these two quantities is the same as the ratio of the radii, and is therefore a constant. A great variety of values will be found for this constant. In the list of astronomical constants in the front of the ephemeris the semidiameter of the moon at mean distance is adopted from Newcomb as 15′ 32.58″, while the equatorial horizontal parallax is adopted from Brown as 57′ 2.70″, giving a ratio of .272469. The logarithm of this quantity is 9.435317. The constant given in step 28 is .272496. As only four places are wanted in the semidiameter according to the model computation, possibly .2725 would do. The semidiameter could also be taken out of the ephemeris by interpolating, and deducting the correction of 1.50″ that has been added to account for irradiation. See the introduction to the ephemeris. As we have to find the parallax we save an interpolation by computing the semidiameter from the parallax. The question of semidiameter is treated by Chauvenet, Vol. I, p. 181. See also pages 104 and 105. As we are going to reduce the observations to the center of the earth we are not concerned with the correction called the augmentation of the semidiameter. We use formula 245, but take the semidiameter equal to its sine. This explains steps 13, 14, 15 = 27, 28, 29.

DIRECTION OF THE MOON'S MOTION

The direction of the moon's motion ϱ can evidently be calculated from the distance the moon travels in right ascension and declination in a unit of time. The ephemeris gives for each hour the change in right ascension and the change in declination per minute of time under the headings Var. per Min. The right ascension differences must be expressed in arc not in time, so the constant of step 56 is the logarithm of 15, the number of seconds of arc in a second of time. As the degrees of right ascension become shorter in length as we leave the equator, the difference in right ascension per minute must be multiplied by the cosine of the declination. The ratio of the distance the moon travels in right ascension to the distance it travels in declination in a unit of time gives the tangent of the angle ϱ that expresses the direction of the moon's motion with respect to the equator. It should be noted that $\Delta\alpha$ and $\Delta\delta$ are not the quantities tabulated under these heads in the tables of elements for the prediction of occultations. This computation embraces steps 9, 10, 56, 57, 58, 59, 60, 61.

APPARENT VALUE OF σ^1

If A, B, C is any spherical triangle, then the following relations are given by Chauvenet on page 28:

$$\begin{aligned}
\sin a \cos B &= \sin c \cos b - \cos c \sin b \cos A \\
\sin a \sin B &= \sin b \sin A \\
\cos a &= \cos c \cos b + \sin c \sin b \cos A
\end{aligned}$$

Let A be the pole, B be the star, C the center of the moon as obtained from the ephemeris. Then

$$\begin{aligned}
c &= 90^\circ - \delta^1 \\
b &= 90^\circ - \delta \\
B &= 180^\circ - \chi \\
a &= \sigma^1 \\
A &= (\alpha^1 - \alpha)
\end{aligned}$$

so that these equations become

$$
\begin{aligned}
-\sin\sigma^1\cos\chi &= \cos\delta^1\sin\delta - \sin\delta^1\cos\delta\cos(\alpha^1-\alpha)\\
\sin\sigma^1\sin\chi &= \cos\delta\sin(\alpha^1-\alpha)\\
\cos\sigma^1 &= \sin\delta^1\sin\delta + \cos\delta^1\cos\delta\sin(\alpha^1-\alpha)
\end{aligned}
$$

The following approximations are introduced

$$
\begin{aligned}
\sin(\alpha^1-\alpha) &= (\alpha^1-\alpha) \qquad & \cos(\alpha^1-\sigma) &= 1-\tfrac{1}{2}(\alpha^1-\alpha)^2\\
\sin\sigma^1 &= \sigma^1 & \cos\sigma^1 &= 1-\tfrac{1}{2}\sigma^{1\,2}\\
\sin(\delta^1-\delta) &= (\delta^1-\delta)
\end{aligned}
$$

and the equations simplify as follows

$$
\begin{aligned}
-\sigma^1\cos\chi &= \cos\delta^1\sin\delta^1 - \sin\delta^1\cos\delta + \tfrac{1}{2}(\alpha^1-\alpha)^2\sin\delta^1\cos\delta\\
&= -\sin(\delta^1-\delta) + \tfrac{1}{2}(\alpha^1-\alpha)^2\sin\delta^1\cos\delta\\
\sigma^1\cos\chi &= (\delta^1-\delta) - \tfrac{1}{2}(\alpha^1-\sigma)^2\sin\delta^1\cos\delta\\
\sigma^1\sin\chi &= (\alpha^1-\alpha)\cos\delta
\end{aligned}
$$

and the third relation becomes

$$(\sigma^1)^2 = (\delta^1-\delta)^2 + \cos\delta\cos\delta^1(\alpha^1-\alpha)^2$$

Now let

$$
\begin{aligned}
x &= \sigma^1\sin\chi = (\alpha^1-\alpha)\cos\delta\\
y &= \sigma^1\cos\chi = (\delta^1-\delta) - \tfrac{1}{2}(\alpha^1-\alpha)^2\sin\delta^1\cos\delta\\
&= (\delta^1-\delta) - \tfrac{1}{2}x^2\sin\delta^1\sec\delta
\end{aligned}
$$

where the angles are expressed in radians. If the angles are expressed in seconds of arc, then the expression for y bcomes

$$y = (\delta^1-\delta) - \tfrac{1}{2}\sin 1'' \, x^2\sin\delta^1\sec\delta$$

The logarithm of $\frac{1}{2}\sin 1''$ is 4.38454 and this is the constant given in step 38. The solution for x and y according to these formulas occupies steps 30, 31, 32, 33, 37, 38, 39, 40, 41, 42, 43, 44. To combine x and y would give the apparent value of σ^1 from the station of the observer while the solution of our problem calls for the value corresponding to an observer at the center of the earth. The following reduction is therefore required.

GEOCENTRIC REDUCTION

Parallax is discussed by Chauvenet, Vol. I, Ch. 4, and our problem is formulated in article 102. If we take the rigorous formula (144) on page 124, eliminate and write in our notation, we obtain

$$\sin(\alpha_1 - \alpha^1 = \varrho^1 \sin\pi\cos\varnothing^1\sin(\Theta - \alpha^1)\sec\delta^1$$
$$\sin(\delta_1 - \delta^1) = \varrho^1 \sin\pi\sin\varnothing^1\cos\delta^1 - \varrho^1\cos\varnothing^1\sin\pi\sin\delta^1\{\cos(\Theta - \alpha^1) + $$
$$+ \sin(\Theta - \alpha^1)\tan\tfrac{1}{2}(\alpha_1 - \alpha^1$$

where

$$\alpha_1 = \alpha^1 + \varepsilon\sec\delta^1$$
$$\delta_1 = \delta^1 + \eta$$

If the small quantity $\sin\pi\tan\frac{1}{2}(\alpha_1 - \alpha^1)$ is considered negligible in this reduction, and if we further replace the sines on the left by their respective angles we obtain the reduction adopted in the computation form. If we compare our formula with the one given on the next page in Chauvenet we shall find that the reduction we are using differs only from formula 145 in the fact that where we use the sine of the parallax, formula 145 uses the parallax itself.

The geocentric reduction may be visualized as follows: Assume reference axes as usual for an eclipse or occultation, the Z axis pointing to the star, the XY plane passing through the center of the earth at right angles to this axis, the Y axis running NS in this plane, and the X axis EW. The plane is called the fundamental plane, and serves as a picture plane for the projection of the earth as seen from the star.

$\varrho^1\sin\varnothing^1$ is the distance between the center of the earth and the center of the parallel of latitude upon which the observer is standing. $\varrho^1\cos\varnothing^1$ is the radius of the parallel of latitude. This small circle is projected on the fundamental plane as an ellipse whose semi-major axis is its true radius $\varrho^1\cos\varnothing^1$ and whose semi-minor axis is the same radius as foreshortened by projection and therefore equals $\varrho^1\cos\varnothing^1\sin\delta^1$. The center of this ellipse is the center of the parallel of latitude and is therefore situated at a distance $\varrho^1\sin\varnothing^1\cos\delta^1$ above the center of the earth on the fundamental plane. If Θ is the local siderial time of occultation, then $\Theta - \alpha^1$ is the hour angle of the star, and the observer will be projected on the fundamental plane so that his coordinates will be

$$\varrho^1\cos\varnothing^1\sin(\Theta - \alpha^1) \text{ and } - \varrho^1\cos\varnothing^1\sin\delta^1\cos(\Theta - \alpha^1)$$

referred to the center of the ellipse, or

$$\varrho^1\cos\varnothing^1\sin(\Theta - \alpha^1) \text{ and } \varrho^1\sin\varnothing^1\cos\delta^1 - \varrho^1\cos\varnothing^1\sin\delta^1\cos(\Theta - \alpha^1)$$

referred to the earth's center. The moon's distance from the earth is equal to the reciprocal of the sine of its horizontal equatorial parallax taking the earth's equatorial radius as unity. If we multiply the coordinates just obtained by the sine of the parallax, we are dividing them by the moon's distance, and hence we are determining the angular differences between the observer and the center of the earth as viewed from the point of the moon behind which the star is disappearing. Conversely, the angular difference so obtained will be the difference in the position of the point of the moon as viewed from the observatory, and as viewed from the earth's center. For a rigorous treatment, see Chauvenet. The reduction of the observation to the center of the earth involves steps 18, 19, 20, 15, 34, 35, 36, 45, 46, 47, 48, 49, 50, 51, 52.

Having obtained x and y, and the geocentric reductions ζ and η we may compute the required geocentric values of σ^1 and χ by the relations

$$\sigma^1 = (x+\zeta)^2 + (y+\eta)^2, \tan\chi = \frac{x+\zeta}{y+\eta}$$

This accounts for the steps 53, 54, 55, 63, 64, 65, 66.

DEDUCTION OF KNOWN DEVIATION

In his communication in A. J. 876, Professor Brown makes an important recommendation which has been incorporated into the computation sheets as steps 21, 22, 23, 24, 25, 26. He says to add $+0.212\Delta\alpha$ and $+0.212\Delta\delta$ to tabular α and δ, respectively, where $\Delta\alpha$ and $\Delta\delta$ are the variations per minute at date. This, he says, is equivalent to adding $7''.00$ to the mean longitude of the moon, almost wholly corrects for the deviation from the theoretical position, and by reducing the magnitude of the quantity to be solved for, makes unnecessary the correction for periodic changes.

A resumé of the formulas may be desired.

$$\sin\pi = \pi - 0.16''$$

$$\sigma = .2725\sin\pi$$

$$x = 15(\alpha^1 - \alpha - .212\Delta\alpha)\cos\delta$$

$$y = (\delta^1 - \delta - .212\Delta\delta) - \tfrac{1}{2}\sin 1''\, x^2 \sin\delta^1\sec\delta$$

$$\zeta = \varrho^1\cos\varnothing^1\sin\pi\sin(\Theta - \alpha^1)$$

$$\eta = \varrho^1\sin\varnothing^1\sin\pi\cos\delta^1 - \varrho^1\cos\varnothing^1\sin\pi\sin\delta^1\cos(\Theta - \alpha^1$$

$$\sigma^1 = \sqrt{(x+\zeta)^2 + (y+\eta)^2}$$

$$\tan\chi = \frac{x+\zeta}{y+\eta}$$

$$\tan\varrho = 15\frac{\Delta\alpha}{\Delta\delta}\cos\delta$$

Θ = local siderial time of occultation
α, δ = moon's coordinates
α^1, δ^1 = star's coordinates
π = moon's parallax
σ = moon's geocentric semidiameter
σ^1 = distance between star and tabular position of moon center
$\Delta\alpha$ = Var. per Min. in α
$\Delta\delta$ = Var. per Min. in δ
χ = angle of occultation
ϱ = direction of moon's motion
ϱ^1 = distance of observor from center of the earth
$\varnothing^1$ = observor's geocentric latitude

Since writing the foregoing, I have discovered an article in the March number of *Popular Astronomy* explaining the same computation, by Professor Leland S. Barnes of Lehigh University. As his presentation is more detailed and insists more on graphical relation, it is especially recommended to those who may be interested.

Reduction of Occultation, Formulae of Lines.

Star: δ Capricorni. Place: Leonia, N. J. Weather:..................

Observer:.............................. Date:..............................

			Logs				Nos			
1	Standard Time						19^h	22^m	$23^s.$	8
2	$\pm\lambda$ E = −, W = +						$+5^h$			
3	Sum = T, (G.C.T.)			Sept.		29^d	0^h	22^m	23^s	8
4	$\pm\lambda$ E = +, W = −						−4	55	57	3
5	Sum = L.C.T.						19	26	26	5
6	RA Mean Sun $+12^h$, at 0^h						0	28	56	69
7	Red. for h, m, s of (3)								3	68
8	Sum (5, 6, 7) = θ = L.S.T.						19	55	26	87
9	$\Delta\alpha$							$+2^s$	44	04
10	$\Delta\delta$							$+8''$	95	6
11	α = Moon's RA at T						21	40	25	55
12	δ = " dec. "						−15	43	27	2
13	π = " par. "							59'	57"	25
14	Constant								−0.	16
15	Sum = π''	3	55	59	5			35	97".	09
16	α' = Star's App. Place						21^h	42^m	$56^s.$	60
17	δ' = " " "						−16	37	52.	4
18	$X = \rho' \cos \phi$ (5 dec.)	9	87	93	0					
19	$Y = \rho' \sin \phi$ "	9	81	34	5					
20	Diff (8, 16) = $(\theta - \alpha')$ arc						−26	52	25	95
21	$(\alpha' - \alpha)^s$							1	$57^s.$	05
22	Corr. $(-.212 \times \Delta\alpha)$								−0.	52
23	Sum = $(\alpha' - \alpha)$							1	50.	53
24	$(\delta' - \delta)''$							−26	65".	2
25	Corr. $(-.212 \times \Delta\delta)$								−1.	9
26	Sum = $(\delta' - \delta)$							−26	67.	1
27	π'' (15)	3	55	59	5					
28	Constant	9	43	53	6					
29	Sum = σ	2	99	13	1					
30	Constant	1	17	60	9					
31	$(\alpha' - \alpha)^s$ (23)	2.	17	76	2					
32	$\cos \delta$ (12)	9.	98	34	4					
33	Sum = x	3.	33	71	5			+21	73.	6

			Logs				Nos		
34	Sum (15,18) = X"	3	43	52	5				
35	sin $(\theta-\alpha')$ (20)	9	65	51	6n				
36	Sum = ζ	3	09	04	1n	-	12	31	4
37	$(\delta'-\delta)$ (26)						-26	67.	1
38	Constant	4	38	5					
39	x^2 (33)	6	67	4					
40	sin δ' (17)	9	45	2n					
41	Sum	0	51	1n					
42	cos δ' (17)	9	98	2					
43	Diff (41,42)	0	52	9n				-3.	4
44	Diff (37,43) = y						-26	63.	7
45	Sum (15,19) = Y"	3	36	94	0				
46	cos δ' (17)	9	98	18	2				
47	Sum	3	35	12	2		22	45.	0
48	X" (34)	3	43	52	5				
49	sin δ' (17)	9	45	24	3n				
50	cos $(\theta-\alpha')$ (20)	9	95	03	6				
51	Sum	2	83	80	4n		-6	88.	7
52	Diff (47,51) = η						+29	33.	7
53	Sum (33,36) = $(x+\zeta)$	2	97	41	4				
54	Sum (44,52) = $(y+\eta)$	2	43	13	6				
55	Diff = tan χ	0	54	27	8	74°	1'		
56	Constant	1	17	60	9				
57	$\Delta\alpha$ (9)	0	38	74	6				
58	cos δ (32)	9	98	34	4				
59	Sum	1	54	69	9				
60	$\Delta\delta$ (10)	0	95	31	1				
61	Diff (59,60) = tan ρ	0	59	48	8	75°	44'		
62	Diff (55,61) $(\chi-\rho)$					-1°	43'		
63	$(x+\zeta)^2$ (53)					88	77	41	
64	$(y+\eta)^2$ (54)					7	29	00	
65	Sum = (σ')					96	06	41	
66	σ'						9	80."	1
67	σ (29)						9	80.	2
68	Diff = $(\sigma'-\sigma)$							-0."	1

The following data were taken from the *American Ephemeris* for 1925:

Step 6 from page 12
7 693
9, 10, 11, 12 93
13 129
16, 17 by applying the correction on page 595 to the mean place on page 567
18, 19 from page 778

Steps 9 and 10 are obtained by single interpolation, steps 11, 12, 13 by double according to the following model. For step 9

$$1929 \text{ Sept. } 29, 0^h 22^m 23.8^s = 22.397 \text{ minutes}$$

$$\begin{array}{ll} \text{Var. at } 0^h & 2.4417^s \\ \text{Var. at } 1^h & 2.4383 \\ \hline \text{Ch. in } 1^h & —.0034 \end{array}$$

$$\text{Ch. in } 22^m 3.8^s = \frac{22.397}{60}(—.0034) = —.0013$$

$$= \text{Var. at date} = 2.4417 — .0013 = 2.4404.$$

For step 11.

Nearest tabulated var. 0^h	2.4417
Var. at date	2.4404
Arithmetical mean	2.4410
2.4410 x 22.397 =	54.67^s
at 0^h =	$21^h 39^m 30.88$
at date =	21 40 25.55

Steps 12 and 13 are computed the same way as step 11.

The constant —.212 is the same for all occultations until notice of a change. The number of places of decimals used in each step should be the same as those in the example.

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A COLLINEATION DIAGRAM OF KEPLER'S EQUATION

It is required to find values of E when M is given and the relation between E and M is such that

$$E - e\sin E = M.$$

A more or less obvious graphical solution due to J. J. Waterson is described in most books of theoretical astronomy, and Bauschinger gives a chart for the purpose in the pocket in the back of his tables. As this method is mechanically complicated, the construction of a collineation diagram naturally suggests itself.

The first step is to express the equation in the form of a third order determinant in which the last column has three ones, while only one variable occurs in each row. With a little juggling the form

$$\begin{vmatrix} \frac{E}{1+\sin E} & \frac{\sin E}{1+\sin E} & 1 \\ M & 0 & 1 \\ e & 1 & 1 \end{vmatrix} = 0$$

is obtained.

We now have three groups to draw

$$x^1 = \frac{E}{1+\sin E} \quad y_1 = \frac{\sin E}{1+\sin E}$$
$$x^2 = M \qquad y_2 = 0$$
$$x^3 = e \qquad y_3 = 1$$

The graph for e is a straight line parallel to the χ axis, a unit's distance away from it. The graph for M is the χ axis itself. The curve for E is obtained graphically as follows:

Plot the curve for

$$x_1 = E \qquad y^1 = \text{sine}E$$

an ordinary sine curve. Now

$$\frac{y_1}{x_1} = \frac{y^1}{x^1}$$

hence if the points of the sine curve be connected with the origin, the required points will lie on the system of concurrent lines so obtained. Further, if $e = 0$, $E = M$. Hence the required points must lie on the system of concurrent lines drawn from the point $(0, 1)$ to the points of M. By taking the intersections in order, the curve for E is obtained. Finally, to obtain a more symmetric arrangement of the scales, oblique coordinates may be used.

To use the diagram we note that the corresponding values of e, E and M are collinear. So to solve the equation we find the value of e on its scale, the value of M on its own scale, and putting a straight-edge across, the corresponding value of E will be found on the E scale collinear with e and M.

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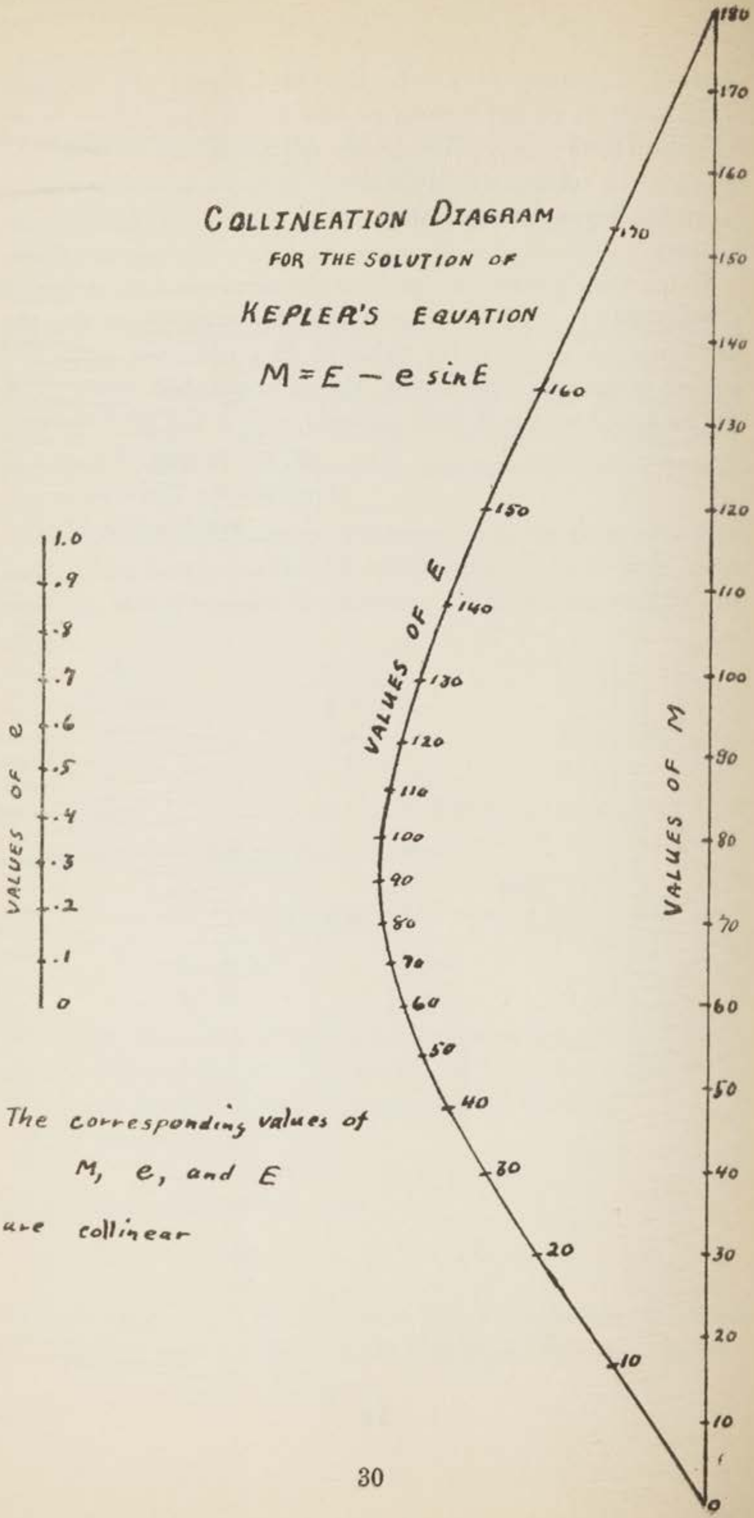
COLLINEATION DIAGRAM
FOR THE SOLUTION OF
KEPLER'S EQUATION

$$M = E - e \sin E$$



The corresponding values of
M, e, and E
are collinear

TOTAL ECLIPSE OF THE MOON AS OBSERVED AT WESTON COLLEGE

The eclipse of November 27, 1928, passed nearly unnoticed here, partly because of the unseasonable hour of its occurrence and partly because of inclement weather. Although the day preceding gave great promise of clear skies, clouds put in a faithful appearance about sunset and by 10:00 P. M. their threatening aspect cancelled many an engagement for the eclipse.

Several cameras were, however, set up, even a motion picture one so as to secure photographs at intervals of a few minutes which would record permanently the gradual decline in brilliance of the moon. All attempts to get a trail were frustrated by the brightly illumined, fleecy clouds, which, though thin enough to see through, fogged the films badly.

As the penumbra approached, the clouds gathered in ever-increasing numbers and formed a large white halo around the moon, while the thermometer dropped to 21 degrees. The moon still remained easily visible. Even at 2:10, more than half an hour after its arrival, the outline of the penumbra could not be distinguished on the surface of the moon. Further observation was then interrupted by a huge bank of clouds that stole in from the west and blotted out the scene completely. The contact of the umbra was hidden by clouds. Finally, about four o'clock, the clouds parted for a few minutes and gave us an excellent view of the total phase.

About one-fourth of the moon was easily visible, but not very conspicuous. It was of an orange hue similar to Mars, like fire seen through smoke or like the filament of an electric lamp burning far below its rated voltage. The southern half of the moon was completely invisible. We found the image of the moon too dim to focus with our telephoto lens and too unsteady on account of the brisk wind, so we gave up the attempt to photograph it. A few minutes later the clouds closed in again and thus ended the visual observation of the moon.

A newspaper clipping the following day said that Dr. Edison

Pettit of the Mt. Wilson Observatory noticed a drop of 414 degrees Fahrenheit on the moon's surface, from 228 above to 186 degrees below zero. Evidently an eclipse of the sun is no joke to the man in the moon! Apart from the intense cold one wonders what happens to the components of his atmosphere! Doubtless the freezing of some of them increases the relative concentration of oxygen in the air and furnishes the necessary stimulus to carry him over alive till the next eclipse!

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NOTES

The Coming of Eclipse of May 9, 1929—Hand

The editor has recently received a communication from Father Deppermann, of the Manila Observatory, in reference to the coming eclipse of May 9, 1929. This eclipse, as anyone who is the least interested in astronomy knows, has a line of totality passing through the center of the Philippine Islands. Fr. Selga, the Director of the Observatory, expects to go to Iloilo to study the eclipse. His intention is to take observations on the decline of solar radiation with his pyroheliometers as the eclipse proceeds. He will also make as complete observations as possible on the various meteorolgical elements. It was Fr. Depperman's intention to assist Fr. Selga, but the fact that the Hamburg Observatory at Bergedorf, Germany, was sending out an expedition to Cebu, or near it, and offered the Manila Observatory a good four-inch lens and telescope tube of four meters focal length with a coelostat, changed Fr. Depperman's plans and in all probability he will associate himself with the German expedition. His plans at present are (a) to obtain photographs of the corona as near the light of the red and green lines of the corona as possible by using appropriate filters. For this, use will be made of a Zeiss four-inch photovisual objective of seven meters focus. This lens after the eclipse will be attached to the Manila equitorial and used as a guiding telescope and also for the lens in the Littrow mounted telescope; (b) the lens loaned by the Hamburg Observatory is to be used in conjunction with the spectroscopes of the Manila Observatory for spectograms of the Solar Corona; (c) with the photographically recording Wulf Electrometer of the Manila Observatory, a record will be made of the potential gradient of atmospheric electricity.

A program has also been mapped out for the study of the fading of wireless waves during the eclipse for the U. S. navy wireless men in the Philippines. This program was forwarded to Washington and was approved as proposed.

The Observatory will send out special time signals through various short and long wave Navy channels during the eclipse.

At Manila, where the eclipse will be about 90 per cent total, it is intended to take very accurately timed photographs of the sun during the various stages of the eclipse. These may be of interest in fixing very accurately the moon's position.

Extract from the *Publications of the Astronomical Society of the Pacific*, Vol. XL, No. 236; Aug., 1928, pages 249 ff.

SALE OF THE CHILI STATION OF THE LICK OBSERVATORY

A letter received by me (Pres. W. W. Campbell, Univ. of Calif.) on July 3, 1928, from Dr. F. J. Neubauer, Astronomer in charge of the Chile Station of the Lick Observatory, University of California, on Cerro San Cristobal, Santiago, Chile, informed me that the observing Station had been sold to the Catholic University of Chile, located in Santiago, in accordance with financial and other terms specified and authorized by the Regents of the University of California. The title to the telescope, the spectrographs, the dome, and all other properties composing the equipment of the Station, is to pass to the Catholic University in April, 1929, at which time Dr. Neubauer will sever his connection with the Station and return to Mt. Hamilton.

It is one of the conditions attaching to the sale, a condition on which both the contracting parties have placed the utmost weight, that in the ten months prior to April, 1929, a member, or two or three members, of the Faculty of the Catholic University of Chile shall have the privilege and duty of engaging continuously in the work of the Chile Station, under the guidance of Dr. Neubauer, in order that a trained and experienced astronomer shall be available to carry on the work of the University Observatory along the lines of the institution's activities during the 26 years of its prior existence. The significance of this obligation is thoroughly comprehended by Dr. Neubauer; and the Catholic University of Chile, in turn, has given expression to its appreciation of the University of California's interest in the future of the Observatory by appointing Dr. Neubauer an honorary member of the Faculty of Physics and Mathematics and a Professor Extraordinary in the Catholic University.

* * * * * * * * *

The plans for the termination of the astronomical observation at the Chile Station, under the auspices of the Lick Observatory, University of California, have not been made without some degree of regret, but it is hoped that the institution will be as successful in the second period of its activity, under the responsibility of the Catholic University of Chile, as it has been in the first period. * * *

On Tuesday, February 25th, Fr. Tondorf lectured at the Carlton Hotel to the Cosmopolitan Club of Washington, made up chiefly of business men, on the "Seismic Coefficient for Construction of Buildings in Earthquake Districts."

On March 12th he lectured in Brooklyn, N. Y., before the Brooklyn Academy of Arts and Science on "Trapping the Earthquake."

The Coast and Geodetic Survey, United States Department of Commerce, has just published for distribution an interesting brochure, entitled, "Earthquake History of the United States (Exclusive of the Pacific Region)." No one engaged in seismological work or teaching geology should be without this booklet on his shelf. A copy may readily be had by addressing a letter to Commander N. H. Heck, at the Survey.

NOTICES

The seventy-seventh meeting of the American Chemical Society will be held at Columbus, Ohio, from April 29 to May 3, 1929.

The seventh Colloid Symposium will be held at Johns Hopkins University, Baltimore, Md., June 20 to 22, 1929.

The annual meeting of the American Association of Jesuit Scientists will soon be announced. We would like to publish the program in the June number of the BULLETIN. Now is the time to choose the topics for the papers.

May 20, 1927

The accompanying wireless message recorded on the Georgetown College Observatory chronograph is of historic interest as announcing the inception of the first non-stop aeroplane flight from New York to Paris. It reads as follows:

QST de NAA RX MIN QRX MIN

QST QST de NAA NAA * *

Pilot Lindbergh in land plane Spirit of St Louis single engine monoplane departed on great circle course from Garden City Long Island for Lands End England and Paris at six fifty two AM May twenty zone plus five time period plane not equipped with radio period request any ship sighting plane make report of fact * naval operations Washn AR AR