ing partly on analysis and partly on graphics. Some interesting conclusions are drawn as to the relative merits of doubly pivoted, three pivoted, and doubly built in arches. These memoirs are rendered more accessible by being issued with their pages cut. They show what a lot of good work may be done by the expenditure by a public body of a very moderate sum on the endowment of mathematical research. We have another example of the same fact in the Cambridge Smith's prizes and the large number of former winners of these prizes who are now Fellows of the Royal Society.

THE widely extended use of the freezing point and boiling point methods of molecular weight determination has been to a large extent rendered possible by the manufacture of sensitive thermometers of the now familiar Beckmann type. In the current number of the *Zeitschrift für physikalische Chemie* is a very interesting paper by Mr. Ernst Beckmann giving a complete history of the differential mercury thermometer, with especial reference to the modifications it has undergone since its first use in freezing point work. He mentions the fact that the original Beckmann thermometer was due to an accident. A costly instrument, divided into 1/100ths of a degree, was being carried in the hand down a corridor when it was broken in half by the sudden opening of a door. In order still to be able to use the thermometer, a small bulb was blown on above the capillary, and from this the present type was evolved through a series of instruments illustrated in the present paper. Some of the thermometers figured are masterpieces of glass-blowing, notably one combining a Beckmann and ordinary thermometer on one instrument.

MESSRS. JOHN WHELDON AND CO. have sent us their latest catalogue of scientific books they have for sale. The catalogue includes many scarce sets of *Journals* and *Transactions*, as well as selections from the libraries of the late Prof. Everett, Dr. C. W. Siemens, and others.

THE most recent addition to the report being issued by the Engineering Standards Committee is the "British Standard Specification and Sections of Flat-bottomed Railway Rails." Copies of the publication may be obtained from Messrs. Crosby Lockwood and Son. The price is 10*s*. 6*d*. net.

WE have received from Mr. Nasarvanji J. Readymoney, of Bombay, a copy of a publication he has prepared entitled "An Outline of Descriptive, Defining Nature-History Tables, Illustrated; or Nature-History Research Thinking Tables; or Work of Genesis Minutely Tabulated." The object of the tables is to enable the student to summarise and classify "all events in nature or creation" in a philosophical manner.

THE February number of the *Journal* of the Straits Branch of the Royal Asiatic Society has reached us from Singapore. Among other important papers we notice contributions by Dr. Charles Hose on various methods of computing the time for planting among the races of Borneo, by Mr. P. Cameron on descriptions of new species of Iphiaulax and Chaolta (Braconidæ) from Sarawak, Borneo, and by Mr. H. W. Firmstone on Chinese names of streets and places in Singapore and the Malay Peninsula.

A NEW and revised edition of the volume of Prof. W. Schlich's "Manual of Forestry" dealing with forest management has been published by Messrs. Bradbury, Agnew and Co., Ltd. The mathematical problems have been simplified, and some of the calculations have been shortened. The appendices have been considerably altered. In the preface to the new edition Prof. Schlich directs attention to the fact that the most urgent need of British forestry is the collection of statistics, which will enable the proprietor and his forester to gauge the economic value of forest operations. He insists that the fully equipped forester must have a good knowledge of mathematics if he is to secure the best results.

A NEW encyclopædia, prepared and printed by Messrs. T. Nelson and Sons, is to be published in forty fortnightly parts under the title of the "Harmsworth Encyclopædia." Three of these parts, each of 160 pages, have been received, and judging from these we do not hesitate to say that the complete work should be a useful aid to students and a responsive friend to general readers. So far as we have tested the parts received, we have found the information accurate and confined to essential points. Of course, it must be understood that within the limited space allotted to any subject only bare outlines can be described; but as references are in many cases given to authoritative works, inquiring readers may be led to pursue their search for information, inspired by what they find in this encyclopædia. The work is liberally illustrated, and as a convenient guide to information which men and women often seek to know it will be of service.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN APRIL:—

April 4. 2h. Mercury at greatest elongation (19° 11′ E.).
5. 23h. Mercury in conjunction with the Moon. (Mercury 7° 28′ N.).
6. 6h. Jupiter in conjunction with Moon. (Jupiter 3° 35′ N.).
9. 11h. 4m. Minimum of Algol (β Persei).
12. 7h. 53m. Minimum of Algol (β Persei)
15. Venus. Illuminated portion of disc = 0·049; of Mars = 0·975.
17. 8h. 18m. to 9h. 12m. Moon occults η Virginis (mag. 4·c).
20–22. Epoch of Lyrid meteors (Radiant 271° + 33°).

DISCOVERY OF A NEW COMET, 1905 *a*.—A telegram from the Kiel Centralstelle announces the discovery of another new comet by M. Giacobini at Nice on March 26.

The position of the comet at 8h. 11·8m. (M.T. Nice) was R.A. = 5h. 44m. 14s., dec. = + 10° 56′ 56″, and its daily movement in R.A. = + 3m., in dec. − 1° 15′.

This shows the object to be in the constellation Orion, about 6m. W. and 3° 34′ N. of Betelgeuse, or a little more than one-fourth the distance from Betelgeuse to Geminorum, along a straight line joining the two. Apparently the comet passed very near to Betelgeuse on March 29.

COMET 1904 *e* (BORRELLY).—A continuation of the daily ephemeris for comet 1904 *e* is given by Dr. E. Strömgren in No. 4004 of the *Astronomische Nachrichten*.

The ephemeris extends from March 29 to May 4, and from it we see that on the first named date the comet will apparently be situated very near to ζ Aurigæ, and will have a brightness of 0·24. Travelling thence in an E.N.E. direction it will enter the constellation Lynx, its computed position on May 4 being R.A. = 7h. 0m., dec. = + 45° 17′, whilst its brightness on that date will be 0·12. The brightness at time of discovery (about mag. 10) is taken as unity.

OBSERVATIONS OF THE RECENT ECLIPSE OF THE MOON.—In No. 9 (1905) of the *Comptes rendus* is published a paper by M. Puiseux wherein he discusses a series of twelve photographs taken between 7h. 32m. and 8h. 12m. on the occasion of the partial lunar eclipse which occurred on February 19.

Amongst other conclusions he states that the apparent changes in the aspects of the circles Messier and Messier A are simply due to differences of illumination and not to

actual variations, and that, whilst the recent observations of these two circles and of Linné are not in accordance with the records obtained prior to 1866, there is no substantial evidence for recent changes in these features such as have been announced by several selenographers. M. Puiseux believes that many of the circles are undoubtedly of later origin than certain systems of divergent streaks seen on the lunar surface.

NEW VARIABLE STARS IN THE REGION ABOUT δ AQUILÆ.—In No. 4005 of the *Astronomische Nachrichten* Prof. Wolf publishes a list of thirty-six newly discovered variable stars in the region about δ Aquilæ. Their variability was detected by the comparison of two plates taken with the Bruce telescope on July 12, 1902, and July 6, 1904, respectively. The positions (1875·0) of the new variables are given in the catalogue, and, together with the positions of four others which are also probably variable, are shown on thirty-two circular charts accompanying the paper, each chart including a field twenty-one minutes of arc in diameter. In a second table the magnitudes of the stars on the two plates mentioned above are compared with the magnitudes as shown on a third plate taken on August 11, 1898.

ORBIT OF THE BINARY STAR CETI 82.—The orbit of the binary star Ceti 82 (designated 395 in Prof. Burnham's catalogue) is discussed by Prof. Aitken in *Bulletin* No. 71 of the Lick Observatory.

The Lick observations confirmed the rapid orbital motion, but have also indicated a very different orbit from that previously published by Prof. See (*Astronomische Nachrichten*, vol. cxliv., p. 359, 1897).

The elements obtained by Prof. Aitken show a period of 24·0 years, and give the G.M.T. of periastron passage (T) as 1899·7. The elliptical orbit is graphically presented, and shows the differences between the observed and computed places. The eccentricity of the ellipse is 0·15, and the apparent length of its semi-major axis $0''\cdot66$ of arc. Prof. Aitken also gives an ephemeris extending from 1905·7 to 1910·7.

RADIAL VELOCITIES OF CERTAIN STARS.—In No. 70 of the Lick Observatory *Bulletins* Prof. Campbell and Dr. H. D. Curtis discuss the radial velocities of Polaris, η Piscium, ε Aurigæ, and Rigel from the spectrograms obtained at Lick during the last eight years.

In the case of Polaris, the measurement of groups of plates taken during the last four years indicated that the velocity of the centre of mass of the rapid pair in this triple system is changing very regularly with a period of at least eleven or twelve years, but the period may be found to be much longer when further observations are completed.

The radial velocity of η Piscium was suspected by Prof. Lord to be variable with a long period, but as no spectrograms of this star were secured at Lick during the period covered by him, the Lick observations do not settle the question, although the values obtained only range from +16·6 to 13·3 km. per second, whilst Prof. Lord's range was from +9·5 to 25·4 km.

The spectrograms obtained of ε Aurigæ fully confirm Prof. Vogel's conclusion that this star is a spectroscopic binary with a period of several years.

Prof. Vogel's view that Rigel has a variable radial velocity is not confirmed by the Lick observers, who rather favour the conclusion arrived at by Profs. Frost and Adams that the apparent variation is only a function of the difficulty experienced in measuring the wide lines.

STAR PLACES IN THE VULPECULA CLUSTER.—In No. 4004 of the *Astronomische Nachrichten* Dr. H. Meyer gives a catalogue of the positions of thirty-five stars in the Vulpecula cluster. The catalogue contains the B.D. number, the magnitude, and the positions, the latter referred to the equinox of 1900·0 for the epoch of observation 1901·6. The precession and the secular variation in each coordinate are also given for each star, and in the case of fourteen of the brighter ones the proper motion, as determined from the discussion of previous catalogues, is likewise given.

THE U.S. COAST AND GEODETIC SURVEY.

THE report of the Coast and Geodetic Survey for 1904 is a record of manifold labours and results which have for their theatre of action an area practically coterminous with that of the United States and all its island possessions. The main body of the report contains a detailed account of the wide range of duties devolving upon this bureau, and in the appendices we have a presentation of discussions and results which must prove of great economic value and interest to surveyors, engineers, navigators, and physicists.

The re-surveys and developments imperatively required to show the changes in harbours and approaches due to works of improvement or the ceaseless action of natural causes along the Atlantic, Pacific, and Gulf coasts of the United States, and to meet the ever-increasing demands of commerce and the Navy for up-to-date charts, particularly of the waters of Alaska, Porto Rico, Hawaii, and the Philippines, gave constant employment to the eleven vessels available for these duties.

In Alaska the work included the continuation of the survey of Prince William Sound, the survey of Controller Bay, and a deep-sea examination from the Strait of Juan de Fuca to Prince William Sound, preliminary to the laying of a deep-sea cable from Seattle to Valdez. The Porto Rico work was continued in certain bays and harbours as well as in the development of the conditions in the off-shore waters. In the Philippine Archipelago the Survey has secured the cooperation of the Insular Government, and a detailed *résumé* shows a most satisfactory progress of the triangulation, hydrographic, topographic, magnetic, and astronomical operations.

The reconnaissance for the primary triangulation along the 98th meridian was completed to the Canadian border, and a scheme was extended eastward connecting this work with the triangulation of the Mississippi River Commission. The execution of the primary triangulation in the Dakotas and Texas was prosecuted at a rate which surpassed even the notable record which had already secured an enviable reputation for the geodetic operations along the 98th meridian, the total extension amounting to 300 miles (500 kilometres). An equal distinction must be accredited to similar work in California and Oregon, whereon remarkable progress has been made in connecting the Transcontinental Arc work with Puget Sound.

The progress of the magnetic work is shown in detail in Appendix No. 3, which includes a table of results of the magnetic declinations, dip and intensity of force observed on land and sea during the year, this being supplemented with full descriptions of the magnetic stations occupied and meridian lines observed. (This report has been noticed separately, NATURE, March 9, p. 449.)

The determination of the longitude of Manila from San Francisco, thus completing the first longitude circuit of the earth, was one of the astronomical events of the year, and in Appendix No. 4 is a comprehensive illustrated report on the various instruments and operations used in the undertaking, with a comparative *résumé* of the various links and results from which the longitude of Manila had been determined from the westward. The generous cooperation of the Commercial Cable Company, through the patriotic enterprise of which the work was made feasible, is gratefully acknowledged. The results of the determinations from the eastward and westward differ only by 0·006s., or about 8·8 feet. The other results of this expedition are the determinations by the telegraph method of the longitudes of Honolulu and Midway and Guam Islands.

The third attempt at representing the tide for the world at large, the first having been made by Whewell and Airy and the second by Berghaus, is described in Appendix No. 5. The advancement in recent years of the general use of the harmonic analysis, and the greatly improved tidal data that are now obtainable for such a great part of the globe, coordinate to make a new presentation of this subject very opportune. The theoretical discussion of the problems involved, the wide range of data and authorities consulted and referred to, the graphic presentation of the cotidal lines, the results presented, and the conclusions deduced, make a most suggestive paper, and one which will be highly interesting to all students of the subject.