

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  $\delta$  AQUILÆ.**—In No. 4005 of the *Astronomische Nachrichten* Prof. Wolf publishes a list of thirty-six newly discovered variable stars in the region about  $\delta$  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  $0^{\circ}.66$  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,  $\eta$  Piscium,  $\epsilon$  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  $\eta$  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  $\epsilon$  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.

The results of the precise levelling operations for the year are published in Appendices Nos. 6 and 7, which submit them in a detail that makes them immediately available for the requirements of surveyors and engineers. These extend the precise level net, as previously published, six hundred miles to the westward, from Red Desert, Wyoming, to Owyhee, in eastern Idaho, and from Holland, Texas, two hundred miles south-west, to Seguin, Texas. An interesting feature is an account of the change in the manner of support for the levelling rods, with the comparative discussion of the old and the new methods, and the consequent confirmation of the importance of the new system.

The account of operations submitted by the assistant in charge gives the story of the work of the various computing, drawing, engraving, and chart divisions of the office in which the results of the field work are discussed or prepared for the publications and charts wherein they are placed at the service of the public.

A full account of the first recording transit micrometer devised for use in the telegraphic longitude determinations of the Coast and Geodetic Survey is submitted in Appendix No. 8, with an account of the exhaustive tests it was subjected to, and a recapitulation of the results of experience with this form of instrument, mainly in Europe, during the last thirteen years. The results of these experiments indicate that with the transit micrometer the accuracy of telegraphic longitudes may be considerably increased if desirable, or the present standard of accuracy may be maintained at much less cost than formerly.

The results of all triangulation in California south of the latitude of Monterey Bay are printed in the concluding appendix in full, including descriptions of stations as well as their latitudes and longitudes and the lengths and azimuths of the lines joining them. In compact and convenient form there is given all the information in regard to this triangulation that is needed by an engineer or surveyor who wishes to utilise the results in controlling and checking surveys or in constructing maps or charts. The locations of more than 1300 points are accurately fixed by this triangulation.

The report, in addition to the details of the foregoing operations and results, contains a record of a wide range of important work for which the aid of the Survey was sought because of the special training of its officers.

#### PROTECTIVE RESEMBLANCE.

AN interesting paper on "Protective Resemblance in the Insecta," by Mr. Mark L. Sykes, is published in the *Proceedings of the Manchester Field Club* (vol. i., part ii). After briefly describing the law of natural selection, as propounded by Darwin, the evolution of new species through variations, and the elimination of the least fit during long periods of time, reference is made to the colours of insects, to the advantage of conspicuous adornment, and the consequent easy identification of those of them which possess some feature repellent to the insect-eating animals. The absence in young animals of an intuitive faculty of discrimination between edible and inedible material in the selection of food is emphasised, and reference is made to authors who have experimented on the subject.

Müller's theory of mutual protection, through similarity of colours and patterns, amongst inedible Lepidoptera, and Bates's explanation of the "mimicry" or simulation of distasteful species by edible species, are described, and the superficial resemblances between entirely different species and genera are attributed to the influence of natural selection and elimination, and the transmission and accumulation of variations. The method by which many of these likenesses are produced is shown by a number of camera lucida drawings of the wing scales of many of the butterflies and moths referred to and illustrated in the article; and the scale variations, in colour, size, pattern and arrangement, which produce a common resemblance in the insects, are described. Another branch of the subject, treated in some detail, is protective resemblance of environment, as seen in the striking similarity of many insects,

especially amongst the Lepidoptera and Orthoptera, to leaves, twigs, moss, &c.; and a number of illustrations are given of resemblance to natural surroundings, three of which we select as examples.

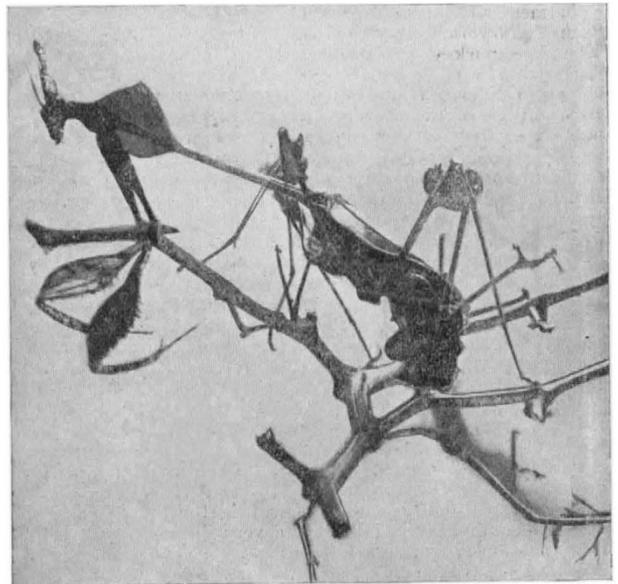


FIG. 1.—*Embusa gongylodes* (Ceylon) at rest on twig

Among the many curious and interesting insects which are found in Ceylon, *Embusa gongylodes* is one of the most singular. It is a brown insect. The thorax is like a long

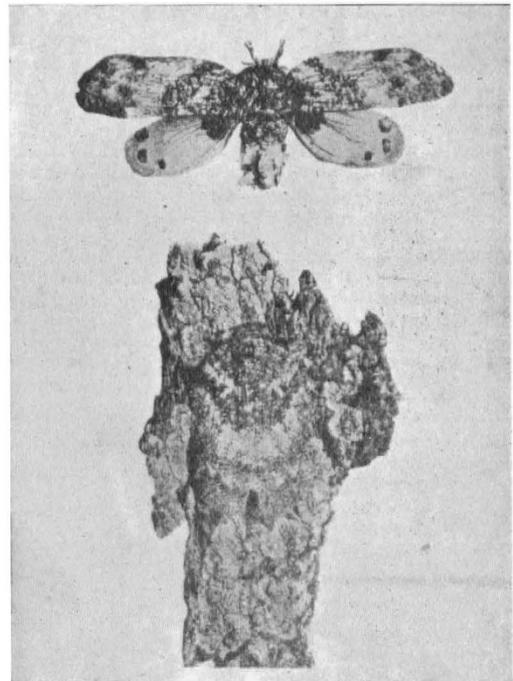


FIG. 2.—*Eurybrachis Westwoodii* (Ceylon) with the wings expanded, and at rest upon a piece of bark.

thin twig, with a wide leaf-like expansion immediately behind the head. The wings are broad, veined and crumpled, like dried leaves, and the long legs, which are spread out in any direction as the animal is at rest, har-