

the Pleiades was made, in part, so that the distances of any pair of these stars might be used as a known celestial arc to be determined in terms of the screw revolution. Dr. Vogel, of Potsdam, determined the value of the screw of the Leipzig refractor by measuring the difference of declination between two stars with the micrometer, and afterwards using the divided declination circle of the equatorial to determine the whole arc. This method was improved in the determination of the value of the screw of the Washington equatorial, by measuring with the micrometer the difference of declination of two *standard* stars (*α* and *ε* *Orionis*) a degree apart. In these last methods the value of the known arc in the sky depends upon our knowledge of the positions of its two terminal points. Dr. Winnecke, of Strassburg, has recently employed an ingenious way, which is even more simple. The distance between some asteroid (whose orbit is well known) and any star near it, is measured on several nights, as the asteroid passes from north to south of the star (let us say). Then, although the absolute position of the asteroid is not known, its daily motions are well determined, and the arc moved over may be used as a known distance from which the value of the screw may be determined.

The following complete list of asteroids (21 in all) discovered by the late Prof. JAMES C. WATSON, Director of the Washburn Observatory, Madison, Wis., has been compiled by the aid of the list of "Minor Planets," published by Mr. A. N. Skinner in the *American Journal of Science and Arts*, Vol. XVIII, Dec., 1879. All of these asteroids, with one exception, were discovered at the Ann Arbor Observatory, Michigan. Juewa was discovered at Peking, China, where Prof. Watson was in charge of one of the Transit of Venus parties.

NUMBER.	NAME.	DATE OF DISCOVERY.
79	Eurynome	September 14, 1863.
93	Minerva	August 24, 1867.
94	Aurora	September 6, 1867.
100	Hecate	July 11, 1868.
101	Helena	August 15, 1868.
104	Hera	September 7, 1868.
114	Clymene	September 13, 1868.
105	Artemis	September 19, 1868.
109	Idone	October 10, 1868.
115	Thyra	August 6, 1871.
119	Althaea	April 3, 1872.
121	Hermione	May 12, 1872.
128	Nemesis	November 25, 1872.
132	Aethra	June 13, 1873.
133	Cyrene	August 26, 1873.
139	Juewa	October 10, 1874.
150	Nuwa	October 19, 1875.
161	Athor	April 10, 1876.
168	Sibylla	September 28, 1876.
174	Phadra	September 3, 1877.
175	Andromache	October 1, 1877.

The report of the *Telegraphic Determination of Longitudes on the East Coast of South America*, by Lieutenant Commanders F. M. GREEN, and C. H. DAVIS, and Lieutenant J. A. NORRIS, U. S. N., has been issued recently from the Hydrographic Office. This work embraces the meridians of Lisbon, Madeira, St. Vincent, Pernambuco, Bahia, Rio de Janeiro, Montevideo, Buenos Ayres and Para, and is designed to supplement the work done in 1877, under the direction of Lieutenant Commander Green, in the West Indies and Central America, by connecting important points in South America, whose longitudes have always been exceedingly uncertain, with well-known places in Europe.

Having made arrangements with the French *Bureau des Longitudes* to furnish the party with the difference of longitude between Lisbon and Paris, the work was begun in December, 1877, by connecting Lisbon, Portugal, with Funchal, Madeira, by means of an intervening station at Carcavellos. This "transmitting" station was found necessary in order to connect the submarine cables with

the land lines; a direct connection endangering the safety of the cables. Partly by cables, and partly by the overland wires, the stations from Lisbon to Buenos Ayres were connected in the order named above, with the exception of a break between Pernambuco and Rio de Janeiro caused by a defect in the cable. These two stations were connected with Bahia, and Pernambuco with Para in 1879; and as the French Government had failed to communicate to the Hydrographic Office the longitude of Lisbon, it was determined to connect Lisbon with Greenwich, in order to make the chain complete. This last connection was effected by means of transmitting stations at Porthcurnow, Lands End, and Carcavellos on the coast of Portugal. The reduction of comparisons of the Lisbon and Greenwich clocks "gives the somewhat startling result that the longitude of the observatory at Lisbon, has, up to the present time, been in error more than two miles." The American determination of the difference of longitude between these two places being  $9^{\circ} 11' 10.2''$ , while that heretofore accepted has been  $9^{\circ} 9' 2.1''$ .

Of the instruments used, the Transit Instrument was of what is known as the "broken transit" pattern (the eyepiece being at one end of the horizontal axis), especially designed for this work by Mr. J. A. Rogers, and fitted to be used as both transit and zenith-telescope. It was of 2.5 in. aperture and 30 in. focal length—made by Kähler.

It seems to have combined considerable steadiness with great portability, as it weighs in all but 125 lbs. In speaking of the performance of this instrument, the report says: "The results of the observations have demonstrated that the reversal of the axis is almost inevitably attended with a slight change of azimuth, and that a correction must always be introduced for flexure of the axis," and adds further on, that these effects "are probably unavoidable in portable instruments of this pattern."

In the reductions, no correction has been applied for personal equation of the observers, either in noting transits of stars, or in receiving the deflections of the galvanometer needle from the cables. After careful experiment, it was found that the correction would be quite small, and in view of the uncertainty involved in its determination, it was decided to take no account of such error, but to eliminate it, as far as possible, by placing one observer alternately east and west of the other, commencing at Lisbon. Advantage was taken of every opportunity to make latitude determinations with the zenith-telescope, and the results in both latitude and longitude show that nearly all of the stations occupied have been up to this time considerably in error.

The spectrum of Hartwig's comet has been observed by Konkoly and Backhouse, and by Young in this country. It gives four bright lines, whose wave-lengths are respectively 5609, 5492, 5169, and 4859 tenth-meters, and a faint continuous spectrum.

W. C. W.

Washington, D. C., November 30, 1880.

### SWIFT'S COMET.

Swift's comet is a faint object, and its distance from the sun is so great, never less than 1.102, and therefore always outside the earth's orbit, that no great changes of form are to be expected, such as we see in comets that pass near the sun.

A. HALL.

To the Editor of Science:

Several interesting observations have been made by me of Swift's latest comet. The last observation was made on the evening of November 26th, at 7.20 P.M.T., being then by estimation in about A. R. 2 hours 30 minutes, north declination 53 degrees 45 minutes. It was quite a conspicuous object in the 5-inch Newtonian Re-

flector, being fully as bright on that date as at any previous observation, although its theoretical brightness is decreasing. It is a faint, diffused object, but to show that it is within the range of quite moderate telescopes, I would say that I first picked it up on the evening of November 5th, with a refractor of only two inches aperture. In my last observation two faint stars were seen shining through the comet.

The comet's position for the 10th of December will be A. R. 4 hours 40 minutes, Dec. + 44 degrees 47 minutes. On December 14th it will be about 5 degrees south of Capella.

WILLIAM R. BROOKS.

Red House Observatory, Phelps, N. Y.,  
November 30th, 1880.

### MICROSCOPY.

Dr. Carpenter, the well-known English microscopist, occupied the attention of the Royal Microscopical Society, on the 6th instant, by describing the "Student Microscope," recently designed by Mr. George Wale, of New Jersey. The instrument in question was highly commended for its efficiency, and English opticians were advised to consider the practical improvements it suggests.

Mr. James Swift exhibited and described an improved form of *Calotte* diaphragm, consisting of a series of small circular apertures, to be applied above the achromatic condenser immediately beneath the object, and on a level with the surface of the stage.

A binocular eye-piece, by Professor E. Abbe, was described as consisting of two uncemented prisms (together forming a thick plate of glass) in the direct tube; the adjacent diagonal surfaces of the prisms being both cut at the calculated angle of  $38^{\circ} 5'$ , which angle was computed to allow precisely one-half of the light to be transmitted, and to reflect the other half; the latter half fell upon a total reflecting prism, whence the rays emerged through the diagonal tube to the left eye. Another point was the mechanism by which the *diagonal* tube attached to the direct tube by a box-fitting, was moved to accommodate the width of different observer's eyes, a screw motion causing the tube, with eye-pieces above and reflecting prism below, to travel smoothly nearer to or further from the direct and stationary tube.

The application of the eye-piece to the left tube at such a distance as to compensate for the extra distance travelled by the pencil of light, and thus render the images seen by both eyes of equal magnitude.

Lastly, the application of two semi-circular caps, one over either eye-piece; in one symmetrical position of these apertures the effect produced was *pseudoscopic* vision, by another arrangement of them stereoscopic vision was obtained.

This form of binocular is said to be specially applicable to the short tubes of Continental microscopes and some of American make.

A new fluid for writing the names of objects on glass slides is sold by Mr. Browning, of London. It is more active than hydrofluoric acid, and has an immediate action on the surface of glass.

Dr. Günther, of Berlin, has made photographs of *Frus-tula Saxonia*. These and a micro-photograph by Mr. S. Wells, of Boston, were compared with the photograph by Dr. Woodward, produced in 1875. The latter showed no trace of beaded resolutions, whereas both the former showed the resolutions remarkably well. Mr. Mayall asks if Dr. Woodward still maintains his opinion of the unreality of the longitudinal lines.

Mr. Crisp mentions that Professor Abbe has found great advantage in mounting diatoms in monobromide of naphthalene, by which they were rendered far more visible than when mounted on Canada balsam.

### BOOKS RECEIVED.

THE NATURALIST'S DIRECTORY FOR 1880. Edited by SAMUEL E. CASSINO, 299 Washington street, Boston. May, 1880.

This useful work will be welcome in scientific circles; it contains the names, addresses, special departments of Study, of Naturalists, Chemists, Physicists, Astronomers, etc., etc., etc. It also gives a list of scientific societies, of scientific periodicals, and the titles of scientific books published in America from July 1, 1879 to October 1, 1880.

The arrangement of the names in this edition of the directory is by States, and was adopted after repeated requests, though not, as the publisher admits, without misgivings on his part as to the convenience of the list thus arranged. On this point we are glad to notice that what we consider to be an error is acknowledged, and that in future the alphabetical order will be resumed. For our purposes the directory thus arranged is almost useless, as the loss of time in searching 45 separate lists for an address, is a great drawback to the use of the work.

We are also at a loss to know on what principle the list has been constructed, as the omission of the names of well-known scientific men is quite incomprehensible; as examples we fail to notice Professor John Le Conte, of California; Professor W. H. Brewer, of Yale; Professor Jas. D. Dana, of Yale; Professor Simon Newcomb, of Washington; Col. J. J. Woodward, M. D., Washington; Professor Asaph Hall; Professor Julius E. Hilgard, Washington; Professor C. Y. Young, of Princeton; Professor C. F. Chandler, of New York City; Professor Henry Draper, of New York City; and Professor Jno. W. Draper, of Hastings-on-Hudson, or Mr. Edison. We have had no time to make a systematic search for omissions, but the above names which are household words in scientific circles do not appear.

As we find some of these names have already appeared in previous editions, the present omission would not appear to be altogether accidental.

As this directory is the only one of its kind published, we suppose these errors will not effect its sale, but we regret that a more perfect work was not produced.

Since writing the above notice, we have heard from the publishers of the Directory; they state that the arrangement of the work is acceptable to a majority of the subscribers, and that the cause of the omission of names was due to their failure to receive responses to printed circulars which were forwarded to all known scientists.

The readers of this journal must be familiar with the efforts we have made to secure a perfect register of the scientific men of the United States. Our intention in this respect was also made known by an editorial notice in the *New York Times*, and in the *Medical Record* of last week.

The *Times* pointed out the value of such a perfect list, and the little trouble it entailed on scientific men. So far the response to our appeal has been very partial. We therefore again request those who have hitherto failed to forward their names and addresses, with speciality of study, to do so at once, and if the heads of Universities and Colleges would make up lists, considerable help would be rendered.

We also suggest that those interested in scientific pursuits make up lists of scientific men in their neighborhood, and of amateurs following a particular line of scientific investigation.

As we stated lists of names will be forwarded to the Smithsonian Institution, and Messrs. Cassino and others will have the full benefit of it for future use.