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SHERBURNE WESLEY BURNHAM,
1838–1921

WE record, with deep regret at his passing, but with high appreciation of his long and valuable service to astronomical science, the death of Sherburne Wesley Burnham, *emeritus* professor of practical astronomy at the Yerkes Observatory, of the University of Chicago.

Born on December 12, 1838, in the upper valley of the Connecticut, at Thetford, Vermont, Mr. Burnham had the ordinary advantages of the district school, supplemented by some study in the local academy, but he did not go to college. He became an expert stenographer and shorthand reporter, long before the days of the typewriter, and this was his profession for some thirty years. During the Civil War he served in his professional capacity with the Union Army while it was occupying the city of New Orleans. He came to Chicago, after the close of the war, and became attached to the United States Courts.

His interest in astronomy must have developed very early in the sixties, for he purchased his first telescope during a visit to London in 1861; and in 1870 he became the possessor of a fine six-inch refractor, a masterpiece of Alvan Clark, which he had ordered in 1869. Mr. Burnham's vision was extraordinarily keen, for among the 451 new double stars which he discovered with that instrument many were found by other observers to be extremely difficult to resolve with much larger instruments.

In 1873 and 1874 he sent five lists of new double stars to the Royal Astronomical Society, which were published in the *Monthly Notices*. At first he had no micrometer, and was obliged to give estimated angles and distances. A correspondence developed with Baron Ercole Dembowski, who gladly made

the micrometric measurements, with his excellent skill, using a refractor of 162 mm. aperture at Gallarate, in Italy. Two lists covering 136 new double stars were printed in the *Astronomische Nachrichten* in 1875 and 1876. A short list followed in the *American Journal of Science* in 1877 and in *Monthly Notices* for the same year. In 1879 his new doubles from Nos. 483 to 733 were published in the forty-fourth volume of the *Memoirs* of the Royal Astronomical Society, together with micrometric measures of 250 other stars.

During the years from 1877 to 1881 and 1882 to 1884, Mr. Burnham had the use of the splendid 18½ inch Clark refractor of the Dearborn Observatory, then set up in the tower attached to the old Chicago University.

In 1879 he was requested by the trustees of the Lick Trust to test the conditions on Mt. Hamilton. He took his 6-inch refractor, now equipped with circles and a driving clock, to Mt. Hamilton and made observations from August 17 to October 16. His highly favorable report settled the choice of Mt. Hamilton as the site for the Lick Observatory. In 1881 he went again to Mt. Hamilton, by request, and observed the transit of Mercury with the 12-inch telescope.

During some six months of 1881 he was astronomer, under E. S. Holden, at the University of Wisconsin, where the 15.5-inch telescope of the Washburn Observatory had recently been erected. While there he discovered and measured 88 new double stars; and he measured a large number of double stars "Selected from his MS. General Catalogue of Double Stars, as specially needing observation." These observations appeared in Vol. I. of the *Publications of the Washburn Observatory* in 1882. Mr. Burnham's famous 6-inch refractor ultimately become a part of the equipment at Madison.

On the inauguration of the Lick Observatory in 1888, with Professor Holden as director, Mr. Burnham received the appointment as astronomer, and thus had abundant opportunities for the use of the great 36-inch Clark refractor for the continuance of his work. At the Lick Observatory he introduced the principle of using the telescope for all it was worth while the sky permitted: in other words, no part of the night when the sky was clear was given up for any bodily weariness of the observer. In 1892, owing to certain conditions at Mt. Hamilton which were unacceptable to Mr. Burnham, he returned to Chicago, where he was offered the highly responsible position of Clerk of the United States Circuit Court. Incidentally he was receiver of the Chicago and Northern Pacific Railroad Company from 1897 to 1902.

Mr. Burnham was in charge of the expedition from Lick Observatory to observe, at Cayenne, the solar eclipse of December 21–22, 1889. Good results were secured, due in no small measure to Mr. Burnham's large experience in photography. The report was written by Burnham and his associate, Mr. Schaeberle, and published in 1891 in a small volume from the Lick Observatory.

On the inauguration of the Yerkes Observatory in 1897, Burnham became an active member of the staff, making his observations throughout the nights of Saturday and Sunday and returning to his duties in the court on Monday morning. In 1902 he resigned his position with the court, despite the life tenure of that office. This gave him more time for his astronomical studies, but he still retained his residence in Chicago, coming to Williams Bay for observations on two nights in the week. He became Professor *emeritus* in 1914, at the age of 75, the statute of the University of Chicago requiring retirement at 70 having thus far been waived in his case. Although the opportunity for using the 40-inch telescope still remained open to him as before, he hardly availed himself of it, and his last observations here were made on May 13, 1914.

Vol. II. of the *Publications of the Lick Observatory* contain his observations from August, 1888, to June, 1892, and his fourteenth to nineteenth catalogues of new double stars discovered at the Lick Observatory in that period, including the numbers from β 1026 to β 1274. The search for new doubles was made chiefly with the excellent 12-inch telescope. He also found some new nebulæ,

and measured the positions of numerous planetary nebulæ which are given in the same volume. His orbits for several of the more interesting systems on which he had been working appear at the end of that volume. It will be seen that Mr. Burnham had largely given up the search for new double stars while at the Lick Observatory, regarding it as more important that accurate observations should be made of the systems already discovered, particularly those for which large instruments were necessary.

Vol. I. of the *Publications of the Yerkes Observatory,* issued in 1900, is entitled "A General Catalogue of 1290 Double Stars Discovered from 1871 to 1899 by S. W. Burnham." It gives in order of right ascension the history of all of the Burnham stars up to β No. 1290. Aside from his own observations, it summarizes the results of all other observers of these stars and gives diagrams and orbits, by the author and others, of several interesting systems. He did not allow himself to be distracted from his specialty by the allurements of other fields of observation: it was seldom that he looked at nebulæ unless there were double stars to be measured therein; and he had no time for observing comets, however interesting. He made an exception in locating Halley's comet on September 15, 1909, two nights after it had been first caught on a photographic plate by Wolf at Heidelberg: thus Burnham's eye was the first to see the comet, then an extremely faint speck, on this return to perihelion.

During the beginning of Mr. Burnham's use of the 6-inch telescope, he felt the great need of a single catalogue of all double stars in the Northern Hemisphere and he therefore arranged a manuscript catalogue of all known double stars within 121° of the north pole. This was conveniently indexed and proved of great service to the observer. He revised it in two MS. editions, the third of which allowed ample room for expansion and is still in use. The preparation of this catalogue had entailed a great amount of labor, as it was constantly kept up to date. Mr. Burnham says of it that "very few will fully appreciate the enormous amount of hard work which has been necessarily expended in the preparation of such a work. . . . It should be remarked in this connection that with the exception of the four years from 1898 to 1902 all this astronomical work, with the telescope and otherwise, has been done when eight or more hours of at least six days in the week were very much occupied with other and different affairs of life." After his retirement from active observations, Mr. Burnham turned this MS. catalogue and the responsibility of its up-keep over to Professor Eric Doolittle, whose premature death in 1920 is much lamented. From him, by prior arrangement, this passed on to Professor Robert G. Aitken, of the Lick Observatory, who thus carries on the work which will eventually result in a new edition of the "General Catalogue of All Double Stars," now to be mentioned. Efforts had been made for many years to have this great work published, but it could not be brought about until the Carnegie Institution of Washington in 1905 undertook to publish it. The composition was done with great care by the University of Chicago Press, and Part I. was published before the close of 1906. It lists 13,665 double stars and summarizes the numerical information about them, in a quarto volume of 275 pages. Part II., of 1,086 pages, gives details of all important observations of the pairs, with many diagrams. It constitutes a *magnum opus* of which any scientist could be justly proud.

With the 40-inch telescope of the Yerkes Observatory, Mr. Burnham gave no time to the discovery of new doubles. In fact, he avoided them, if possible, and occasionally mentioned seeing some which he did not record. In recent years he took a good deal of interest in the determination of the proper motions of the brighter stars by micrometrically connecting them with neighboring faint stars, for which a negligible proper motion could be assumed. This work was largely to lay the foundation for a greatly increased knowledge of proper motion in the future. Mr. Burnham realized very fully the great advan-

tage in accuracy that such relative positions, obtained with a telescope of long focus, had over absolute measurements with the meridian circle. His extensive observations in this direction appeared in 1913, in Publication No. 168 of the Carnegie Institution of Washington under the title: "Measures of Proper Motion Stars Made with the Forty-Inch Refractor of the Yerkes Observatory in the Years 1907 to 1912." This is a quarto volume of iv + 311 pages and includes a total of about 9,500 measures.

The great General Catalogue contained Mr. Burnham's otherwise unpublished work at Yerkes from 1899 to 1906. Between 1907 and 1911 six extensive papers of his observations appeared in *Astronomische Nachrichten,* and a final collection of measures in the *Astronomical Journal* in 1918.

It will be inferred that Mr. Burnham was a very systematic as well as industrious observer. The writer recalls his answer, to the usual inquiry of what kind of a night he had had, that he had measured 100 pairs besides setting on a number of other stars which were too close to be separated under the particular conditions of "seeing." It should be remembered that these observations were made with a refractor having a focal length of 63.5 feet, and the accomplishment of so much with so large an instrument implies every economy of time in passing from one object to another. His program was very carefully drawn up and no time was wasted in reversing the telescope, which was always pointed toward the east of the meridian so as to "keep ahead of the game."

Mr. Burnham's experience in the courts gave him a critical view of scientific evidence which is not enjoyed by all scientists. His attitude toward new discoveries, except by men in whom he had confidence, was one of some reserve. It was hard for him to believe that there could exist stars of such short periods as the many found among the spectroscopic binaries; but he ultimately came to believe the results from his confidence in the men who obtained them. In a discussion, his premises were often broad, but his logical processes were usually very accurate, so that the conclusions were sound unless he was too tolerant with his premises.

Although an expert in amateur photography, and fully appreciative of the remarkable pioneer work of his colleague Barnard in various astronomical applications of photography, still Mr. Burnham seemed to have a lingering doubt as to the superiority of modern astrometrical procedure on the dry plate, with the use of rectangular coordinates, as compared with the visual use of the micrometer for position angle and distance.

Of a genial nature, Professor Burnham had many friends, and was devoted to them; his regard for some of the federal judges with whom he had been associated was little short of veneration. He always expected that any astronomer passing through Chicago would call upon him; and at least enjoy his hospitality at luncheon.

The duties of his regular life did not make it possible for him to attend many of the meetings of the so-called learned societies. We do not find a record of his having attended a meeting of the Royal Astronomical Society, of which he was a loyal member from 1874 and of which he was elected an asssociate in 1898. In 1894 he received the Gold Medal of the Society for his researches and the annual address was by the then president, Sir William Abney, who has lately died at an advanced age. The honorary degree of A.M. was bestowed upon Mr. Burnham by Yale University in 1878; the honorary degree of Sc.D. in 1915, by Northwestern University. The Lalande Prize of the French Academy of Sciences was awarded to him in 1904.

The impress left upon his branch of astronomy by Mr. Burnham has been equalled only by his great predecessors, the Struves, Wilhelm and Otto; the Herschels, William and John; and Baron Dembowski—for all of whom he had the greatest admiration, and to the last of whom his "General Catalogue" was dedicated.

Mr. Burnham married in 1868 Mary Cleland, who survives him, with their three sons

and three daughters, together with eight grandchildren.

He had been in feeble health for the past two or three years, and suffered a broken hip from a fall, toward the end of February. He died on March 11, 1921, at his home in Chicago.

EDWIN B. FROST

YERKES OBSERVATORY,

THE CENTENNIAL EXPEDITION OF INDIANA UNIVERSITY TO PERU

BETWEEN June, 1918, and June, 1919, the Irwin Expedition of Indiana University as a part of its work collected the fishes in the highlands of Peru, particularly in the Urubamba valley from the headwaters at La Raya, elevation 14,150 feet, to Santa Ana, 3,000 feet. This work was done by Dr. C. H. Eigenmann and Miss Adele Eigenmann. Collections were made in the upper Huallaga basin between its headwaters about Cerro de Pasco and Goyllarisquisca down to near Tingo Maria, 1,800 feet, mostly by the present writer. Further collections were made from Lake Junin, 13,500 feet, near Cerro de Pasco, in the Mantaro basin to Huancayo, 10,500 feet, by myself and the Eigenmanns. Collections were also made from the headwaters of the Tarma River at Tarma, 10,000 feet, down to La Merced, about 2,500 feet, by the Eigenmanns. The Irwin Expedition thus collected in the headwaters of the Huallaga and Ucayali Rivers from their sources to the neighborhood of 2,000 feet above sea level.

In May of 1920 I started on the so-called Centennial Expedition of Indiana University to carry the survey of the fish fauna to the lower levels of the rivers of eastern Peru. The expedition was assisted by a grant from the Bache Fund of the National Academy of Sciences, and by the hearty cooperation of the Peruvian government, which provided free transportation and other assistance within Peru.

The writer traveled alone, so far as the English-speaking personnel of the expedition is concerned, depending solely upon local aid. At times help was volunteered by interested individuals or solicited from the local authorities, civil and military. Three weeks of the initial portion of the trip (from the Perené to the Ucayali) were spent in company with Professor J. Chester Bradley and Dr. W. T. M. Forbes, of the Cornell Entomological Expedition.

The plan of the present expedition has been to collect as exhaustively as posible the fishes of a few suitable, representative localities in the basins of the above-named rivers, comprised for the most part within the great Department of Loreto. Entering by Lima, Tarma and La Merced, the writer began where the Irwin Expedition left off two years ago, and crossed to the head of navigation of the Pichis-Pachitea-Ucayali system by the Via Central. Ten days were required to traverse the final 200 kilometers of this atrocious trail. It is an endless succession of mudholes, yet the principal and almost sole means of communication between coastal Peru and her transandine provinces.

No real hardship is involved in making this journey, thanks to the series of government *tambos,* or shelter houses, at convenient distances, which cater very well to those who come well recommended. This is otherwise a region entirely devoid of inhabitants.

Ten days were spent at Puerto Bermudez. Two days by canoe brought the party to a point on the Pichis to which the steam mail launch could ascend. Thenceforward travel was chiefly by launches, mail and commercial, which abound in Loreto; the shorter trips into tributary streams and lakes were made in dugouts. A month was devoted to the vicinity of Contamana on the lower Ucayali, a fortnight to the Puinahua and Pacaya, and an equal period to the region of Iquitos. The markets of Iquitos are in season very well supplied with fresh fish of great variety. Another month was spent in cruising the upper Marañon from Iquitos to the Pongo de Manseriche, and the tributaries Tigre and Morona. A three-week sojourn in and about Yurimaguas allowed an examination of the lower Huallaga, the third of four great rivers