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THE PROGRESS OF ASTRONOMY IN 1893.

BY GEORGE A. HILL, WASHINGTON, D. C.

THE year 1893 beheld a most rapid progress in all branches of astronomy. It will be our purpose to call attention to the more important advancements that have been made, and also to items of especial interest, as a complete resumé of the subject would reach far beyond the limits of this article.

In instrumental equipment we have passed beyond our present apparatus, and we are launching out upon a most wonderful improvement in instruments and their accessories. The mounting for the great telescope for the Yerkes Observatory has been completed, and was on exhibition at the World's Fair. The tube will be at least sixty-four feet long. The object glass of forty inches clear aperture is a reality, and Alvan Clark, its makers has said that it will be finished the coming summer.

Brashear has completed the star spectroscope, and is about to commence the solar spectroscope and the spectro-heliograph.

Professor Pickering has received from the maker, Clark, a twenty-four inch photographic telescope, the gift of Miss Bruce, of New York. The telescope will be mounted on a high mountain of the Andes, in Peru, and from that elevation its whole energy will be concentrated upon a photographic map of the heavens.

Father Algúe has just departed for Manila, in the Philippine Islands, at which point he will install an astronomical observatory. The most important instrument that accompanies Father Algúe is an equatorial, with an object glass of nearly twenty inches clear aperture. The mounting is by Saegmüller, of Washington, D. C., the object glass by Mertz, of Munich, and is a companion to that at Strassburg, and the one at Milan, which has been productive of so many interesting observations in the hands of Schiaparelli in his measurement of double stars, and the markings upon the planets, especially Mars. It was the writer's pleasure to recently wish Father Algúe God-speed in his long journey and a rich measure of success from the results of his observations to be made in that far-off land.

The Greenwich Observatory has accepted from the maker, Sir Howard Grubb, an equatorial with an object glass of twenty-eight inches aperture, and the Astronomer Royal reports that it is satisfactory.

The United States Naval Observatory, one of the most magnificent and complete astronomical edifices in the

world, both in instrumental equipment and offices for the astronomers, was during the year formally opened.

The Dudley Observatory at Albany, N. Y., has, under the wise administration of its director, Professor Lewis Boss, been moved to a more desirable site, a new twelve-inch object glass by Brashear has been supplied, the other instruments repaired and refitted with all modern conveniences, and a substantial residence built for the director in proximity to the instruments.

Dr. S. C. Chandler, of Cambridge, Mass., has presented to the astronomical world a remarkable series of papers, commenced in 1891, and continued through the past year. The exhaustive investigation undertaken by that gentleman has led to the proof that the earth's axis of rotation is not invariable, but that a variation of latitude does exist. Dr. Chandler has made a thorough discussion of all astronomical observations, which bear upon the determination of latitude from the time of Bradley down to the present date, and any one who has read his papers must be convinced that he has almost in sight the law that controls the variation in latitude. He has made a thorough discussion of the work of Struve, Peters, Gylden and Nyrén at Pulkova, with both the prime vertical and vertical circle instruments; observations made at Washington with the prime vertical in 1862-66; Küstner's zenith telescope work; observations made at Cambridge, Leyden, Melbourne and Greenwich; Doolittle's zenith telescope work, and Comstock's and Brown's meridian circle observations at Madison. All these have been discussed in a masterly manner, and from them has been established the fact that the revolution of the earth's pole occupies a period of about 427 days, moving from west to east, the amplitude being a variable and probably entangled with a yearly period.

In connection with what has been said, the reader will find in *Nature*, vol. XLVIII., page 451, a very interesting paper by Professor C. L. Doolittle, given as his address as Vice-President of Section A (Astronomy) at the last meeting of the American Association for the Advancement of Science, held last summer at Madison. Professor Doolittle's paper covers every historical fact connected with the subject of the variation of latitude, besides giving valuable information from the results of his zenith telescope observations carried on so many years at Bethlehem, Pa.

Mr. S. Kostinsky, of the Pulkova Observatory, presented last February to the Imperial Academy of Sciences, St. Petersburg, a paper containing observations made of close zenith stars with the prime vertical transit instrument at that observatory, for the express purpose of determining the amplitude and period of the variation in latitude, recently dug up by Chandler. From that series an amplitude of $0.60''$, with a period of 412 days, is demonstrated. Mr. Kostinsky's paper will be found in *Bulletine de l'Académie Impériale des Sciences de St. Petersburg*, tome VII., page 367.

Upon exhibition at the World's Fair was a new form of pendulum devised by Sigmund Riefler, of Munich. Mr. Leman read a very interesting paper before the Congress of Astronomy held in Chicago, which was a description of the pendulum. His paper appeared in the December number of *Astronomy and Astro-Physics*. Accompanying the article was a table extracted from the records of the Royal Observatory at Munich, giving the daily rate of the clock controlled by one of Mr. Riefler's pendulums. The period covered by the table is from September 1, 1891, to September 2, 1892, or one year. Dr. Seeliger, the Director of the Observatory, states, in forwarding the table, that with a variation of temperature up to 30° centigrade no influence worth mentioning on the rate of the clock could be perceived. The mean daily