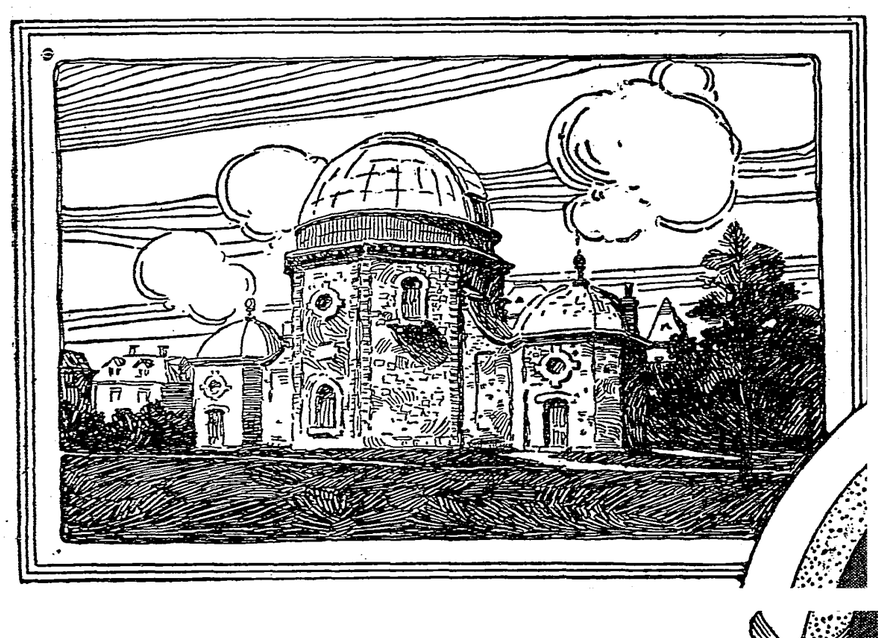
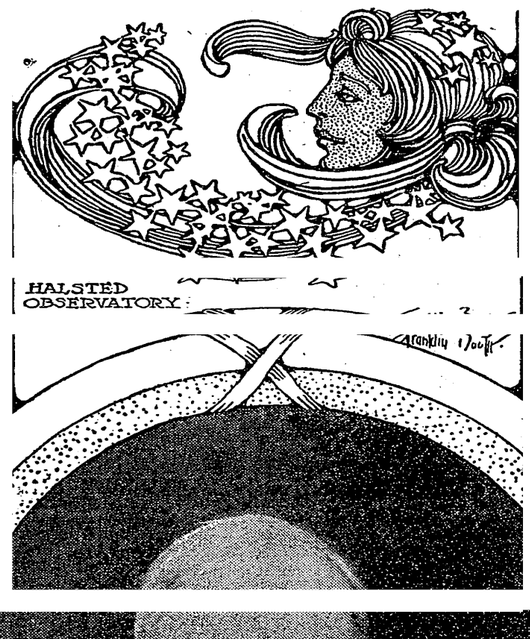
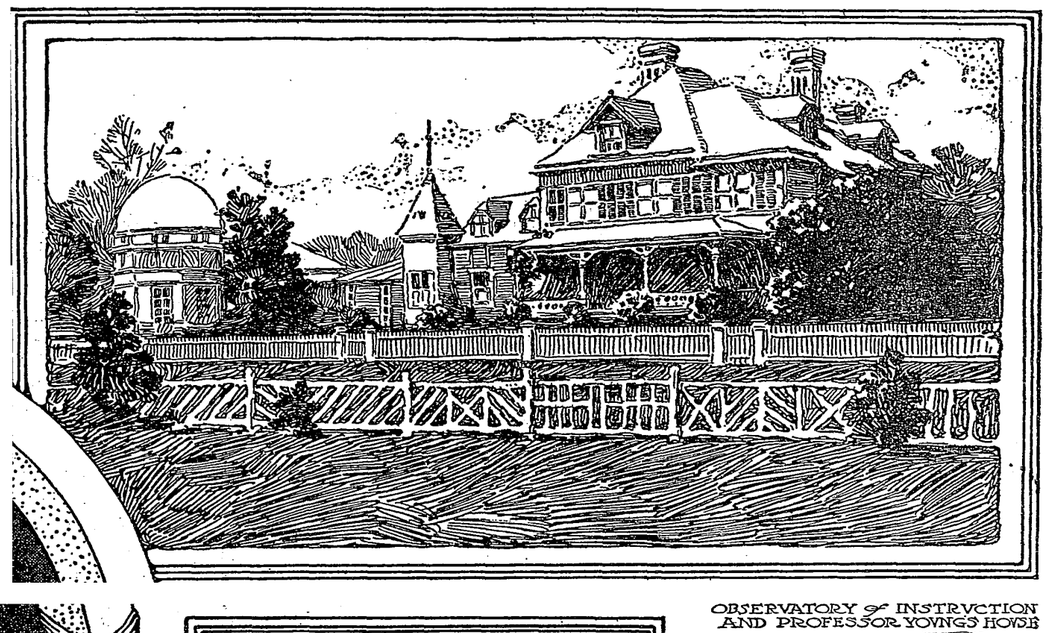
What Science Owes to Professor Young

Retirement From Active Work of Princeton's Famous and Much Loved Astronomer.

BY MARY PROCTOR.

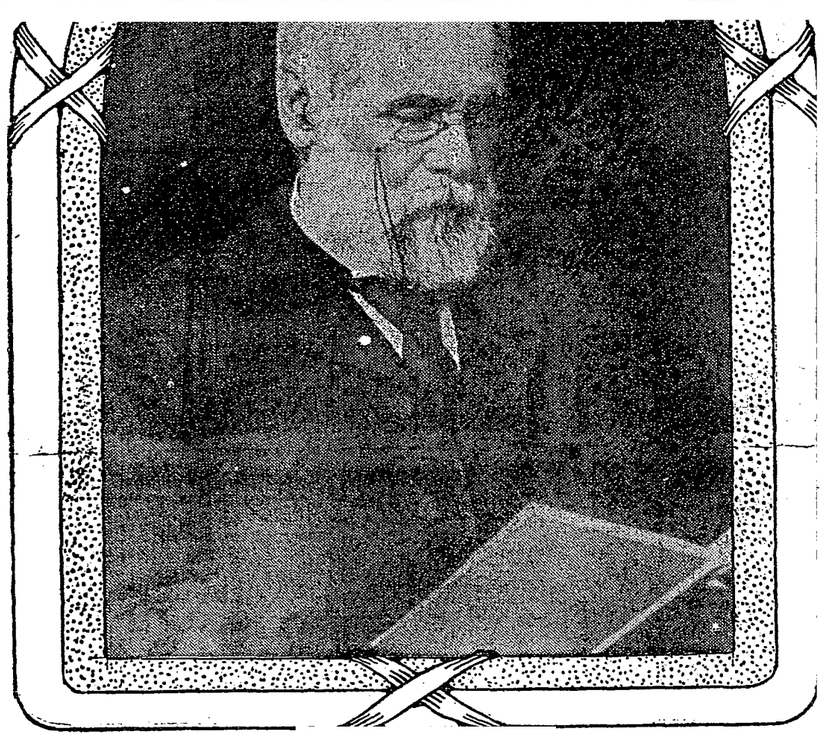




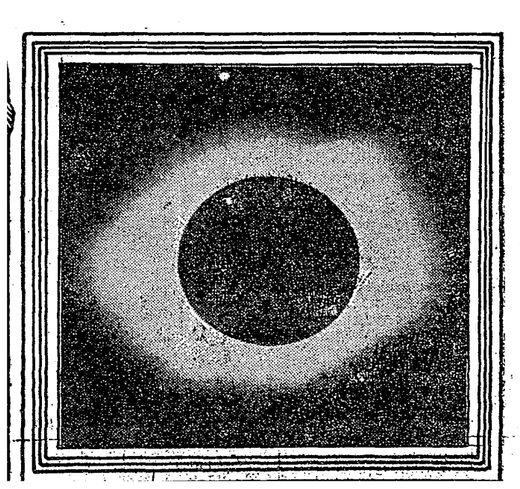


OBSERVATORY OF INSTRUCTION AND PROFESSOR YOUNG'S HOUSE

For Over Half a Century Prof. Young Has Sought to Make the Study of Astronomy Popular---His Name a Household Word with Every Star-Lover---Richard A. Proctor's Daughter, Who Visited Him Last Week, Gives a Brief but Interesting Survey of His Brilliant Career.



PROF. C. A. YOUNG



SOLAR CORONA. TWELVE FT. TELESCOPE. 20 SECONDS EXPOSURE.

I KNOW I am mortal and the creature of a day. Yet when I search the close set whirling circles of the stars no longer do I stand with feet upon the earth, but, seated with Jove himself, I take my fill of the breath of heaven."

These words in Greek were inscribed on a loving cup presented to Prof. Charles A. Young at a banquet given at Princeton Inn a few days ago as a testimonial of the appreciation of his colleagues. The astronomer will retire from active work in June, after twenty-eight years of service in Princeton University. Practically fifty-two years of his life have been spent in teaching astronomy, and his chief aim has been to make it popular, which he has undoubtedly succeeded in doing. His inspiring influence as a teacher has not been limited to his own classroom, for he is widely known by means of his series of textbooks on astronomy.

The sale of these books up to the present time, amounting to about 120,000, is an indication of their well-known merit and unique popularity. The following is a partial list of the books written by Prof. Young since 1882: "The Sun," a second edition of which was published in 1898; "General Astronomy," of which 26,000 copies have been sold up to date; "Elements of Astronomy," sale 39,000; "Lessons in Astronomy," sale 53,000; "Manual of Astronomy," sale 5,000, &c. He has also published more than 200 papers of all sizes, from extended articles of 20 pages or more down to single-page notes. The long articles have been for the most part popular in character.

While at Dartmouth, where he was Professor of Natural Philosophy and Astronomy, from 1866 to 1877, he took up solar spectroscopy with considerable success in the observation of prominences and sunspots. He was the first in 1873 to use the diffraction grating in solar spectroscopy. While at Princeton he continued the work sporadically, and in 1891 was first to recognize vanadium as prominent in the sun-spot spectrum. In fact, Prof. Young is specially renowned for his investigations in solar physics.

During the course of his busy life he has found time to give lecture courses of from four to ten lectures each, at the Lowell Institute, Boston; thirteen university extension courses in various places, and since 1870 as nearly as can be estimated, about a hundred single lectures not in courses. At Mount Holyoke Seminary, now Mount Holyoke College, he has lectured annually on physics and astronomy, (alternate years,) from 1868 to 1883, and has lectured there on astronomy biennially, from 1883 to 1903. He has also lectured at Bradford Academy, Mass., biennially, from 1872 to 1898; Wheaton Seminary, Norton, Mass., from 1882 to 1897, and Miss Porter's School, Farmington, Conn., from 1890 to 1898.

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Meanwhile he has taken an active part in several eclipse expeditions, the first being the eclipse of 1869, at Burlington, Iowa. On this occasion he found the bright line in the corona spectrum. At the eclipse of Dec. 22, 1870, visible in Jerez, Spain, he found the spectrum of the "reversing layer," in recognition of which discovery he received the Janssen medal in 1891.

The eclipse of Dec. 22, 1870, though lasting only two minutes and ten seconds, drew observers from all parts of the world to the shores of the Mediterranean. Janssen issued from beleaguered Paris in a balloon, carrying with him the important parts of a reflector specially constructed to collect evidence about the corona. But he reached Oran only to find himself shut behind a cloud-curtain more impervious than the Prussian lines. Everywhere the sky was more or less overcast. Sir Norman Lockyer of the Royal Astronomical Society, England, journeyed from that country to Sicily, and was shipwrecked on the way. When he finally succeeded in reaching his destination he was recompensed with a glimpse of the solar aureole during one second and a half! Three parties stationed at various heights on Mount Etna saw absolutely nothing. Nevertheless important information was obtained in despite of the elements.

The prominent event was Prof. Young's discovery of the "reversing layer." This beautiful phenomenon, superbly seen for the first time at Jerez de la Frontera in Spain, he describes as follows: "As the moon advances, making narrower and narrower the remaining sickle of the solar disk, the dark lines of the spectrum for the most part remain sensibly unchanged, though becoming somewhat more intense. A few, however, begin to fade out, and some even turn palely bright a minute or two before the totality begins. But the moment the sun is hidden, through the whole length of the spectrum, the red, the green, the violet, the bright lines flash out by hundreds and thousands, almost startlingly; as suddenly as stars from a bursting rocket-head, and as evanescent, for the whole thing is over within two or three seconds. The layer seems to be only something under a thousand miles in thickness, and the moon's motion covers it very quickly."

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The theory regarding this so-called "reversing layer" was disputed by Sir Norman Lockyer, and in a letter addressed to the editor of Nature, from Kio Island, off the western coast of Norway, previous to the eclipse of Aug. 9, 1896, he wrote as follows: "A plate will be exposed ten seconds before the end of totality to fifteen seconds after, in the hope of catching the so-called 'flash' which is supposed to represent the 'reversing layer.' To my mind, the reversing layer is dead and buried already, but may the fates be propitious on the 9th and enable us to place a wreath on its tomb."

As it happened, the theory was confirmed, for just at the critical moment Mr. Schackelton, one of Lockyer's own assistants, took a photograph of the "reversing layer," and the photographic plate established its identity forever. Knowing Prof. Young's keen appreciation of a joke, his friend, Mr. Huggins, an English astronomer, wrote to him on hearing of the confirmation of the theory, quoting as appropriate for the occasion the well-known couplet in the story of "Old Mother Hubbard," "who went to the cupboard to get her poor dog a bone." She also

"Went to the joiner to get him a coffin,
And when she came back, the dog was a-laughing."

The observation of the "reversing layer" was again confirmed at the total eclipse of Jan. 22, 1898, when very satisfactory photographs were obtained of the solar spectrum by observers in India. On this occasion Mr. E. Walter Maunder, F. R. A. S., who had made special arrangements for photographing the spectrum of the reversing layer, had a most aggravating experience. In attempting too much, by having too many instruments to attend to without any one to assist him, he found, too late, that one spectroscope which had been exposed during the brief period the reversing layer was visible, was still exposed when the crescent sun came into view. He had forgotten to close the shutter in the hurry of the last moments of totality, and as a result the faint corona spectrum nearly faded outright.

Several partial confirmations of the observations of the flash spectrum have since been visually obtained at eclipses, though none so complete as desirable, but the photographs of the "flash spectrum," as it is now called, obtained during the recent eclipses of 1896, 1898, 1900, and 1901, made with various forms of the prismatic camera, (a camera of long focus, with a prism, a train of prisms, or a "grating" outside the object glass,) have fully corroborated it. An exquisite photograph of the flash spectrum was obtained by Sir Norman Lockyer in India during the eclipse of 1898.

Nevertheless, Sir Norman Lockyer has never admitted the existence of any such thin "reversing layer," maintaining that a large proportion of the dark lines are formed only in the regions of lower temperature, high up in the sun's atmosphere, and not close to the photosphere, i. e., different lines of a given substance originate at very different elevations in the solar atmosphere.

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The reversing layer forms the densest portion of the lower atmosphere of the chromosphere or color sphere. It is so called because it is brilliantly scarlet, owing the color to hydrogen, of which it is mainly composed. In structure it is like a sheet of flame overlying the surface of the photosphere (or outer shell of the sun) to a depth of from 5,000 to 10,000 miles, and as seen through a telescope at a total eclipse of the sun has been aptly described as "a prairie on fire."

Projecting upward from the chromosphere and moving with a velocity varying from 50 to 200 miles a second, are the solar flames or prominences. They are very beautiful and interesting objects, sometimes presenting the appearance of vast clouds of roseate hue resting on the surface of the sun, the interlacing branches of trees, or jets of spray from a fountain. They change in appearance with marvelous rapidity, and Prof. Young, who has observed hundreds of them, had the following remarkable experience: On Oct. 7, 1880, he was observing a sunflame which attained the unequaled height of 350,000 miles. (Forty-four globes the diameter of the earth would not quite reach to the tip of this mighty flame.)

When first seen on the southeast limb of the sun, about 10:30 A. M., it was a "horn" of ordinary appearance, some 40,000 miles in elevation, and attracted no special attention. When next seen, half an hour later, it had become very brilliant and had doubled its height; during the next hour it stretched upward until it reached the enormous altitude mentioned, breaking up into filaments which gradually faded away, until by 12:30 P. M. there was nothing left. Telescopic examination of the sun's disk showed nothing to account for such an extraordinary outburst, except some small and not very brilliant faculae.

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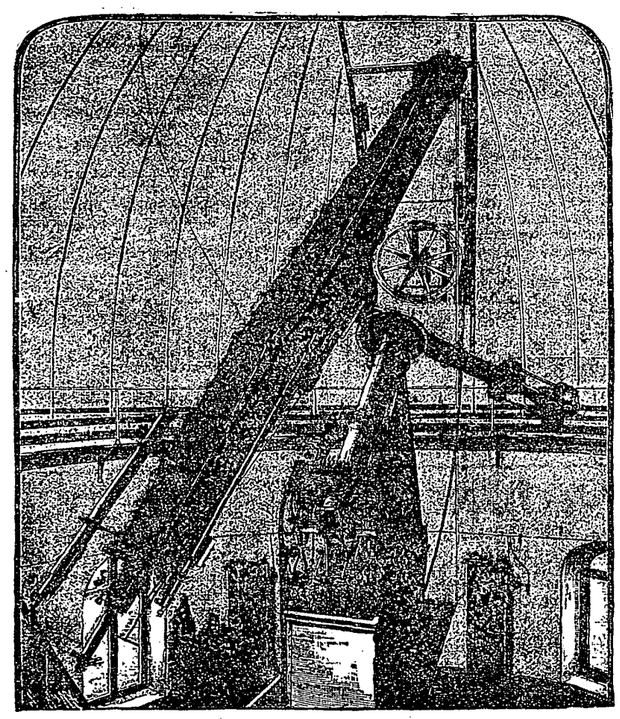
At the eclipse of 1878, observing parties were scattered all along the line of anticipated darkness in the United States, where, above the Rocky Mountains, the skies were remarkably clear. Located at Cherry Creek Camp, near Denver, was Prof. Young, who took several photographs of the corona, having provided himself with a thirteen-inch objective, on a scale much larger than usual at that time. The Princeton party consisted of about fifteen. The observations were fairly successful.



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In 1887 Prof. Young prepared to observe the eclipse near the western end of the eclipse track, a station about 120 miles northeast of Moscow. But the path of this ill-fated eclipse was shrouded in clouds for nearly its entire length, and only a few photographs of the corona were obtained. At the station occupied by Prof. Young and his party of six astronomers a misty rain was falling much of the time during the eclipse. At the middle of the eclipse the darkness was hardly greater than in a heavy thunderstorm; the moment when "totality" began could not be determined with any accuracy at all, and its close was doubtful by some seconds. Fine print could be read all the time.

The last expedition in which Prof. Young took part was in May, 1900, when the Princeton eclipse expedition went to Wadesborough, N. C. This total eclipse of the sun had long been looked forward to with interest by American astronomers as being the first visible in the Atlantic States for more than thirty years, and as offering along its track many easily accessible stations with favorable probabilities in respect to weather. Princeton had several times before sent out eclipse observers: In 1834, 1854, 1860, and 1869 Prof. Alexander had made journeys to Georgia, Northern New York, Labrador, and Iowa to observe the eclipses of those years, and in 1878 and 1887 Prof. Young had taken parties to Colorado and Russia on similar errands. It seemed therefore only proper that on this occasion also Princeton should be represented in the field.

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Prof. Young gives this account of their experiences:

"More than a year in advance Wadesborough, N. C., had been fixed upon as our station. A beautiful site for our observation camp was secured just east of the village, within five minutes' walk of the Court House, on the brow of an eminence giving a wide, unbroken view for ten or twenty miles toward the east. Our party, when we left Princeton on May 17, consisted of nine persons, who all participated in the observations of the eclipse.

"On account of the shortness of the total phase, (about a minute and seventeen seconds,) and for other reasons unnecessary to detail, it was thought best not to include in our programme observations involving the construction of new and expensive instruments, but to limit ourselves to observations which could be made with the existing apparatus of the university observatories, modified and adapted, so far as necessary, in the School of Science machine shop.

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"Our instrumental equipment included the nine-and-a-half-inch equatorial of the School of Science observatory, with its mounting complete except the iron pier; an equatorial mounting carrying three photographic cameras, a four-inch telescope, the three-and-a-half-inch Fraunhofer instrument so long 'the telescope' of Princeton during all the years of Prof. Alexander's service. We also had the spectograph of the Halsted Observatory, an 'analyzing spectroscope,' an 'integrating spectroscope,' and the slitless spectroscope, for observing the 'flash-spectrum' and the coronal rings. We carried, of course, numerous other minor articles of apparatus—a mean-time chronometer, a time counter, a clinometer, various eye pieces, colored glasses, direct-vision prisms, &c., with a full assortment of photographic supplies.

"The morning of the eclipse was cloudless and brilliantly clear. Every one was at his post in good season, and the observations went through without any interruption or mishap. With one exception the observations were successful, and in this failure we only shared the common fate of most of those who on this occasion attempted the same determination. In this case the object aimed at was to determine accurately the position (wave length) of the bright green corona line in the spectrum of the corona. As it happened, the corona was far less brilliant than usual."

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Very interesting observations were also made of the shadow bands as they rippled over two tent flies spread on the ground. They first appeared about a minute and a half before totality, and were about two inches in width, wavy and irregular, made up apparently of short, overlapping curves a few inches long. At first moving with the speed of five to seven miles an hour, this increased enormously—to "the velocity of an express train."

In 1874 Prof. Young went to Peking as astronomer of a party headed by Prof. Watson, to observe the transit of Venus. "The special interest of the transits lies in their availability for the purpose of finding the parallax and distance of the sun, as first pointed out by Halley in 1679. A transit takes place when Venus passes between the earth and the sun at inferior conjunction and 'transits,' or crosses, the disk of the sun from east to west as a round black spot, easily seen by the naked eye through a suitable shade glass. When the transit is central it occupies about eight hours, but when the track is near the edge of the disk it is correspondingly shortened."

Prof. Young's observations on this occasion were successful, and again at the transit of Venus in 1882. However, the observations were then made at Princeton, the outfit and methods being the same as those employed by the Government parties, which took up positions scattered over the globe, from Queensland to Bermuda.

In other lines of work Prof. Young has measured the diameter and ellipticity of Mars, Uranus, and Jupiter; made some hundreds of observations of double stars, (not yet published,) and many observations of comets and their spectra, and lunar eclipses, &c. But observational work was always made secondary to the work of instruction.

During the Summers of 1859, 1864, and 1865 he was engaged on lake survey. For 100 days during the Summer of 1862, he was Captain of Company B of the Eighty-fifth Ohio Volunteer Infantry, the company being composed mainly of college boys never under fire. In 1870 he was appointed member and Secretary of the Board of Visitors for West Point, and from 1901 to 1903 he was a member and President of the Board of Visitors for the United States Naval Observatory, Washington, D. C. He has also been Trustee of Meriden Academy, New Hampshire, 1867-72; Trustee of Mount Holyoke College since 1880, and Lawrenceville School since 1892.

Prof. Young is a member of innumerable societies, being Vice President of the American Association for the Advancement of Science in 1876, and President in 1888. He is also a member of the Dartmouth Scientific Club, the Princeton Scientific Club, the National Academy of Sciences, the Philosophical Society of Philadelphia, the American Academy of Science and Art, Boston; the Cambridge (England) Philosophical Society, and the Washington Academy of Sciences. He is an honorary member of the New York Academy of Sciences and the Brooklyn Institute, and an associate member of the Royal Astronomical Society of Great Britain and the British Association for the Advancement of Science. He is also a member of the following college societies: Beta Theta Pi, Alpha Delta Phi, and Phi Beta Kappa.

Prof. Young received the degree of Ph.D. at the University of Pennsylvania, 1870, and at Hamilton College, New York, in 1871. He has also received the degree of LL. D. from the Wesleyan University, Connecticut, in 1876; Columbia University, New York, in 1887; Western Reserve University, Ohio, 1893, and Dartmouth College in 1903.

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Thus, laden with honors and happy in the assurance that he has done even more than his share in the "world's work," it seems only fair that Prof. Young should now enjoy a well-earned rest. That he will be missed goes without saying, and it is doubtless with a feeling of regret that he leaves Princeton, which has been his home for so many years. Yet he has the consolation of knowing that his work is fully appreciated, this being aptly implied in the closing lines of a poem by Dr. Henry van Dyke, and read by him at the banquet given a few days ago in honor of the ever-popular Princeton astronomer:

"So take our thanks, dear reader of the skies,
Devout astronomer, most humbly wise,
For lessons brighter than the stars can give,
And inward light that helps us all to live.
The world has brought the laurel leaves to crown
The star discoverer's name with high renown;
Accept the flower of love we lay with these,
For influence sweeter than the Pleiades.
For though the hour has come when we must part,
That influence long shall live within our heart,
And we shall know thee traveling on thy way
Into the brightness of a heavenly day."

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Prof. Young owns a small house in Hanover, N. H., in which he has been accustomed to spend the Summer, and where he expects to move next July to spend the rest of his life. He will remain connected with Princeton as professor emeritus, with a salary about two-thirds of his present salary.

He is a member of the Congregational Church, and is a Deacon during his residence at Hanover. In fact, he was one year (1855-6) in the Andover Theological Seminary, studying for the ministry, but eventually changed his plans. He fitted for college in the local academy and under private teachers. In September, 1849, he entered Dartmouth College, was graduated A. B. at the head of his class in 1853, and A. M. in 1856.

On Aug. 26, 1857, Prof. Young married Augusta S. Mixer of Concord, N. H., who died in Princeton Jan. 18, 1901. There were three children, Clara E., (Mrs. H. A. Hitchcock,) widowed in 1895, and now residing with her father and her son, Charles Y. Hitchcock, aged fourteen; Charles Ira, engineer in the employ of the Westinghouse Electric Supply Com-

(Continued on following page.)

SCIENCE'S DEBT TO PROF. YOUNG

(Continued from preceding page.)

pany, Philadelphia, and Frederick A., United States Coast and Geodetic Survey. His father was Ira Young, Professor of Natural Philosophy and Astronomy from 1833 till his death, in 1858. He was a lineal descendant of Sir John Young, who, with five others, received in 1626 a grant of the "north shore" of Massachusetts, extending from Boston to the mouth of the Merrimac. The grandfather of Ira Young was present at the battle of Lexington.

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Prof. Young's mother was Eliza Minot Adams, daughter of Prof. Ebenezer Adams, Professor of Mathematics, Natural Philosophy, and Astronomy from 1809 to 1833. Prof. Adams was a son of Ephraim Adams of New Ipswich, who was a member of the Committee of Safety, and for a time in the Revolutionary Army, the ancestry dating back to a Rev. Charles Adams, in Charlestown, Mass., about 1636, (not the Presidential family.)

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Personally Prof. Young is most unassuming, and, although it was with some trepidation that I ventured to approach him in search of material for the above article, his cordial greeting when I stepped from the train at Princeton placed me entirely at ease. Together we wandered across the university campus, on the way to his house, while the professor pointed out the different buildings and told me their use and names.

He seemed to take special pleasure in drawing my attention to Nassau Hall, where, as he informed me, the British took refuge at one time during the battle of Princeton, in 1777. Being a Britisher myself, I naturally resented the idea of our soldiers "running away and hiding themselves," as Prof. Young expressed it, but when I turned and looked at him in surprise, the merry twinkle in his eyes showed me that he was just having a little joke at my expense. By the way, those who know him well among the students often refer to him as "Twinkles," on account of this peculiarity I had just noticed. I ventured to ask him if he was aware of this fact and he replied:

"Yes, indeed, and they call my grandson 'Twink.'"

When we arrived at the professor's house two cats were stretched out at full length on the porch step, and regarded us with a calm air of indifference as we approached. The professor seemed very much amused at them, and informed me that their names were Bob and Bobbina. They apparently expected the professor to play with them, and he did, showing that even astronomers will sometimes stoop from observation of things celestial to terrestrial objects such as cats.

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We then went into the professor's library, where I felt very much at home, as I recognized books and pictures of the same kind which had become familiar to me for so many years in my father's study. The professor then showed me the beautiful loving cup which was presented to him May 18, and of which he is very proud. He pointed to the Greek inscription (quoted at the beginning of this article) and showed me the menu of the banquet.

The professor then took me through the Observatory of Instruction, which is devoted entirely to the use of students, and is fully equipped for its purpose. Here are the telescopes, spectroscopes, &c., already referred to as being in use at Wadesborough, N. C., at the time of the total eclipse of the sun May 28, 1900. There were also two standard clocks and five subsidiary clocks, including one specially invented by Prof. Young. I then had a glimpse of the nine-and-a-half-inch telescope which was *the* telescope until the installation of the great equatorial of nearly twenty-three inches aperture and thirty feet focal length. It is housed in the Halsted Observatory, a stone building with a dome thirty-nine feet in diameter, the power for moving it and its sliding shutter being furnished by an electric motor and a storage battery.

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But time was fleeting, and once more we wandered across the campus, but this time in the direction of the Princeton station. There was something pathetic in the thought as I said "good-bye" to the professor, that he, too, would soon be saying "good-bye" to Old Nassau, with all the associations which must (for him) cling around its ivy-clad walls.

MARY PROCTOR.