
SIC ITUR AD ASTRA
ANNIE JUMP CANNON 1863-1941

ANNIE JUMP CANNON

1863-1941

Annie Jump Cannon, born in Dover, Delaware, educated at the Wilmington Conference Academy, Dover, and Wellesley College was hailed at her death as a "Delaware Great" and the world's most famous woman astronomer, who brought distinction to her sex, her state, and her country.

She was born on December 11, 1863, the daughter of Wilson Lee and Mary Jump Cannon. Her father, a wealthy ship-builder, achieved distinction as a member of the Delaware legislature by casting the deciding vote which committed Delaware to stay in the Federal Union in 1860. Her mother had studied some astronomy at Friends School, Philadelphia, and imparted the love of the skies to her daughter. As a small child, Annie made observations with the aid of a smoking candle and was fascinated by the spectroscopic effects of candlelight on a prism candelabrum in the family home. With instruction from her mother, and an old astronomical chart, she would climb from the attic of her family home on State Street and, from the roof, pick out the larger stars and constellations.

She attended the Wilmington Conference Academy (now Wesley College) from 1877 to 1880, becoming the eleventh woman to be graduated from that institution. At the time of her matriculation in the Academy, it had already become one of the early forerunners of what was to be called the junior college. In her senior year, young Annie would have had her first formal course in astronomy, a required subject in the Classical Course, studying Loomis's *Astronomy.*

From there she went to Wellesley College, receiving the A. B. degree in 1884, after studying under Dr. Alice Freeman and Professor Sarah F. Whiting. She returned to Dover, after receiving her degree, and remained there for the next ten years, appearing on the rolls of the Conference Academy as a "student of music" in the years 1886-1889.

She returned to Wellesley for advanced study in mathematics, physics, and astronomy, and as a "volunteer assistant" to Professor Whiting. It may have been in their experiments with x-ray, in 1896, that she developed the photographic skills which were to further her later work.

In 1897, she transferred her activities to Radcliffe College and the Harvard Observatory, where a growing collection of photographs of the stars had become famous. Here she studied under Professor Edward C. Pickering and developed the system for classifying the spectra of the stars still in use as the "Harvard classification."

In 1911, Annie Jump Cannon was made curator of astronomical photographs at Harvard. In the course of her photographic work there, she discovered 300 variable stars, five new stars, one spectroscopic binary, and numerous stars having bright lines or various spectra. She completed a catalogue of 272,150 stellare spectra which fills 10 quarto volumes of the *Annals* of the Harvard College Observatory, including the nine-volume *Henry Draper Catalogue*, listing all the bright stars in the sky down to the ninth magnitude, and containing catalog numbers, positions, visual and photographic manitudes and spectral types, with individual notes. It has been said that these notes include observations of hundreds of stars which have been "discovered" since her time.

This work completed, she undertook the "Extension to the Henry Draper Catalogue," which extended her work to the cataloging of over 400,000 stellar bodies.

In 1938, she was named William Cranch Bond astronomer and curator, a post she held until a few months before her death.

Dr. Cannon received the M. A. from Wellesley in 1907; a D. Sc. from the University of Delaware, 1918; and Doctor of Astronomy, from the University of Groningen, Holland, in 1921, at that time, the highest honor ever accorded an American woman by a foreign university.

In 1925, she became the first woman to receive an honorary degree from Oxford University and the second person elected an honorary member of the Royal Astronomical Society of Great Britain. Other universities which honored her with degrees were: Mount Holyoke, Oglethorpe, and Wellesley, her alma mater.

She was awarded the Henry Draper Medal for investigations in astrophysics in 1931 by the National Academy of Science and, in 1932, the Ellen Richards prize for astronomical research. The money she received from prizes, she turned over to the American Astronomical Society, to be given to an outstanding woman astronomer every three years.

Modest of her accomplishments, Dr. Cannon once said: "My success, if you would call it that, lies in the fact that I have kept at my work all these years. It is not genius, or anything like that; it is merely patience."

Annie Jump Cannon believed strongly in the exchange of scientific ideas as a means of promoting international amity and spoke often of an international "diplomacy of the stars." At the outbreak of World War II, shortly before her death, she said:

"In these days of great trouble and unrest, it is good to have something outside our own planet, something fine and distant and comforting to troubled minds. Let people look to the stars for comfort and find solace as others have."

ASTRONOMY YESTERDAY

with Wellesley's famous astronomer, Annie Jump Cannon '84

The picture of Annie Jump Cannon taken for her graduation in 1884 shows us a face that reflects the quality of her mind, bright with intelligence and alert with curiosity. She seems to be looking beyond today to tomorrow, beyond the earth to the sky—the stars. And that is precisely what Annie Jump Cannon did for most of her life, look at the stars, analyzing and cataloguing and recording their spectra to become an internationally famous woman astronomer. In 1923 she was named one of the twelve greatest living women by the National League of Women Voters.

Her study of astronomy began in the attic of her home in Dover, Delaware, where as a child she observed the stars through an open window and by the light of a smoking candle recorded her observations. At Wellesley she pursued her studies, returning after graduation for further work in physics and astronomy with Sarah Frances Whiting. Their laboratory, established in 1879, was part of the organ loft and garret at one end of the fifth floor of College Hall; they used largely improvised equipment and for the study of astronomy had only a celestial globe and a 4-inch Browning telescope, which had to be taken for use to the roof of the south porch.

Miss Cannon did graduate work at Radcliffe, and came in contact with the astronomical work going on at Harvard Observatory. She joined the staff there in 1897 under Edward C. Pickering, and in 1911 began the monumental Henry Draper Catalogue of Stellar Spectra, which was published in nine volumes of the Annals of Harvard Observatory *and is a reference work for astronomers today (with some modern supplementary work, notably by Mrs. R. Newton Mayall). Stars are still identified by their "Draper numbers." It had been discovered in 1885 that by putting a prism in front of the objective of a photographic telescope, the image of each star, instead of appearing as a point, would be spread into a line, the rays of different wave lengths being diverted by the prism to different points upon the plate. The principal lines in the spectra appeared in these bands, and several hundred star spectra could thus be obtained in a single photograph. It was by this means that Miss Cannon was enabled to record over 400,000 classifications of stars, and these groupings, according to the metals shown in their spectra, gave the key to the evolutionary development of the stars.*

She was an honorary member of the Royal Astronomical Society of Great Britain and of the American Philosophical Society of Philadelphia. An exhibit honoring Dr. Cannon in the Delaware State Museum in 1959 included some of the honorary degrees and academic hoods which she had received from Mount Holyoke, University of Gröningen in Holland, University of Delaware, Oglethorpe, and Wellesley. There was also a cap, gown, and diploma from Oxford University, where she was the first woman to be so honored.

Mrs. R. Newton Mayall is the custodian of Miss Cannon's papers, and is working on her biography. It is thanks to Mrs. Mayall that the Alumnae Magazine *is able to present the following excerpts from Annie Jump Cannon's address to her classmates on the occasion of her 50th reunion:*

As I look about me, an old conviction comes back with renewed force. It is that the modern college girl is much more

From Wellesley Alumnae Magazine, vol. 54, #2, Winter 1970. Gift of Mrs. H. W. Rinehart, Wilmington, Del., 19809.

Annie Jump Cannon had only a four-inch Browning telescope on roof of south porch of College Hall with which to make observations.

clever than we were. I thought once I had found the reason why. It was a glorious day at the summer home of Professor and Mrs. Niels Bohr, near Copenhagen. The thatch-roofed old house was on the edge of a great forest not far from the sand cliffs of the Kattegat. Besides Professor Bohr, famous for his model of the atom, there was Sir Arthur E. Eddington, champion of an expanding universe, and Dr. Howard Shapley, keen on Metagalactic theories. The talk fell upon some of the really inconceivable revelations of the new physics and new astronomy. Professor Bohr suggested that the human mind, still in a state of rapid development, would grow up to these ideas. Pondering over the matter, it occurred to me that the modern girls' superiority could be accounted for by the 50 years of mental growth between our time and theirs.

One of the first explorers of the Garden of the Gods in Colorado remarked that he pitied those who visited it after hearing or reading about it, for they could never experience his joy and surprise upon its unexpected sights, such as coming suddenly upon the vision of Pike's Peak framed in those great roseate columns.

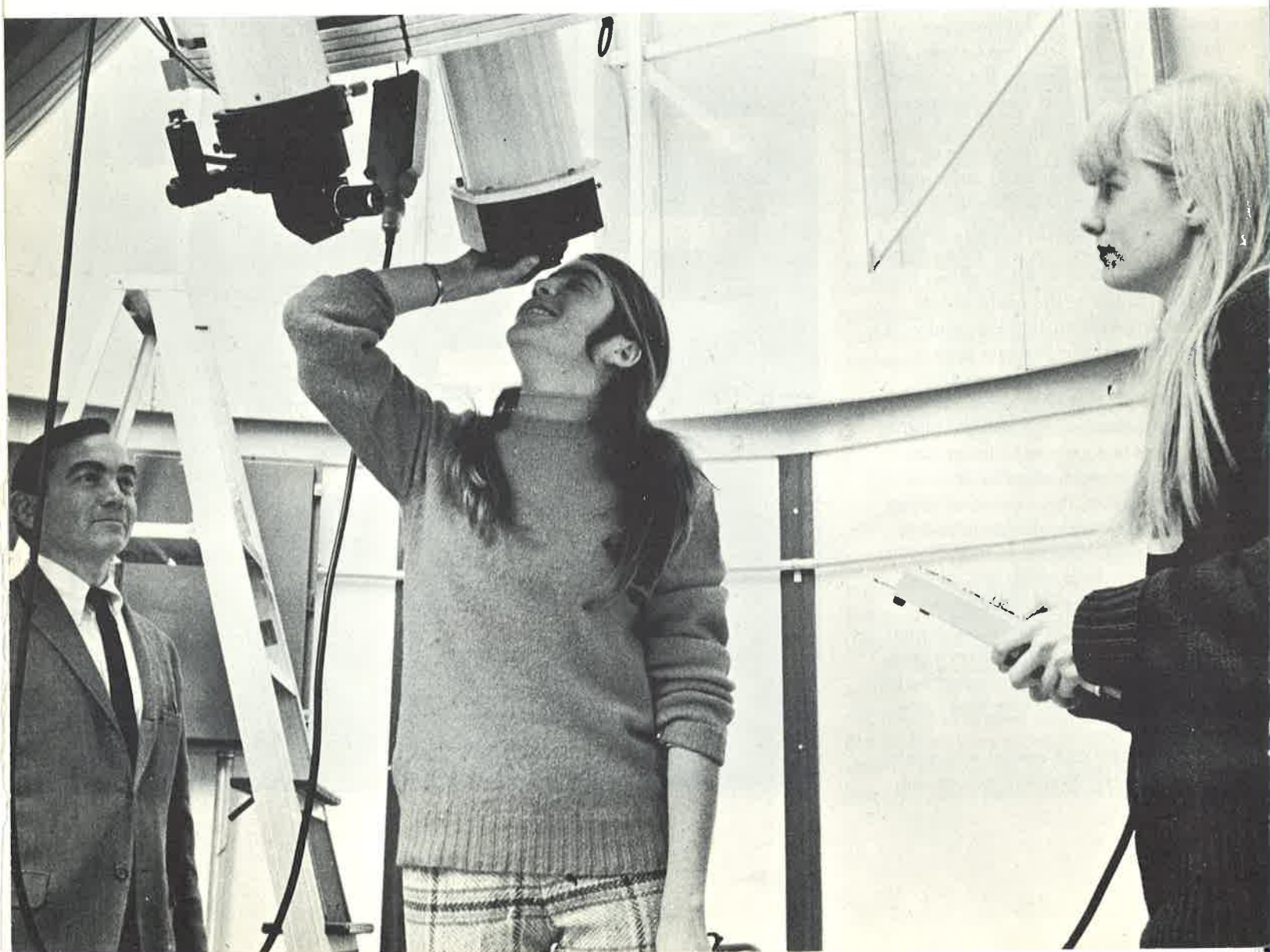
Likewise was Wellesley a novel Garden of the Gods. We were awed by College Hall, an eighth of a mile long, by Miss Howard (Ada E. Howard, President of the College), so handsome and stately in sweeping black silk and puffs all over her

ASTRONOMY TODAY

by Sarah J. Hill, Professor of Astronomy

When Miss Cannon studied astronomy at Wellesley probably eighty per cent or more of the material included in today's introductory astronomy courses was unknown. Indeed, a substantial part of it was unknown at the time the parents of our present students were in college. At a time when observational data is proliferating and ideas changing at a revolutionary rate, the academic pressures are toward shorter terms and shorter courses; in Wellesley as elsewhere year courses have given way to semester courses. The Department of Astronomy is currently trying to cope with this trend by offering a single introductory course—a one-semester survey, with laboratory work and an extensive observing program (extensive, that is, in relation to the New England skies which are cloudy about fifty per cent of the time!). In the two sections of this course offered in each semester there are a total of some two hundred and thirty students this year. They come from all four classes, and scientists, non-scientists, and anti-scientists are included in a very inhomogeneous class. For the first time, this year an assistant has been added to the regular staff of two full-time faculty members specifically to handle the night work. He is ably assisted by undergraduates, majors and nonmajors, girls who have taken astronomy and have been trained to use the telescopes, who are paid by the College for this work. The survey course is necessarily a large lecture course. One might question whether this is the ideal way to introduce students to a science, but it is certainly a challenge to teach.

At the intermediate level we offer three courses quite different



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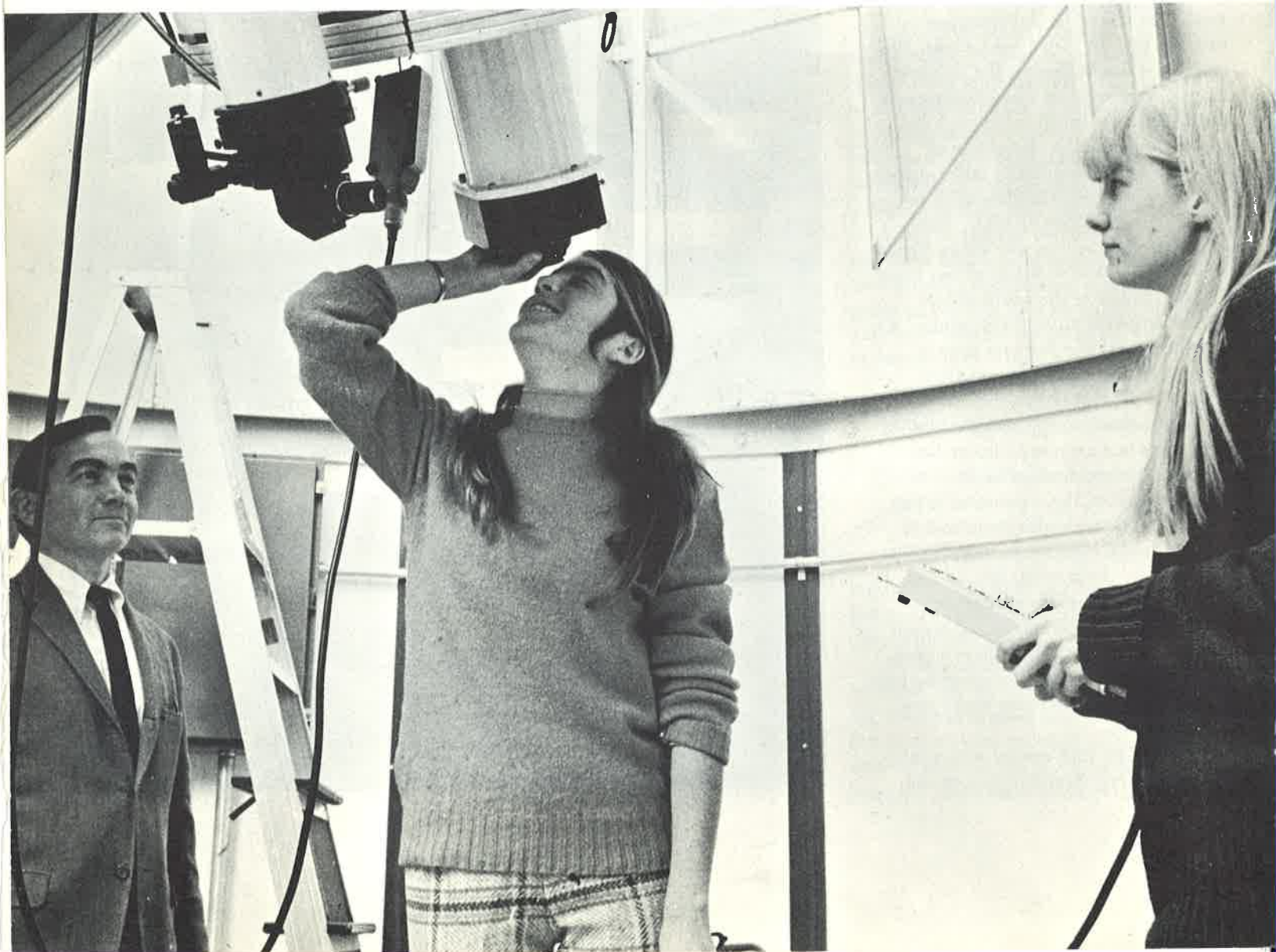


...es' Tutoring Program forms a plan of creative, academic, and recreational activities tailored to the wishes and needs of his or her tutee. Meetings are held twice each week for an hour at the St. John's-St. James' Church in Roxbury, and tutors are encouraged to arrange additional individual meetings also. Tutors, students from Harvard and Wellesley, read selections from black literature each week in partial preparation for a discussion group, the purpose of which is to begin toward solving black-white and person-to-person problems that arise in and outside of tutoring.

Jan Thomas '72:

Massachusetts Welfare Rights Organization is the fastest-growing welfare rights group in the country. Under the direction of Bill Pastreich, the poor are being urged to form united fronts, to recognize their rights, and to act together to gain improvements. I became interested in welfare rights when my political science professor Mark Stern pointed out the possible agencies for Wellesley's urban involvement at the beginning of the year. Welfare rights is the kind of organization which puts into action the democratic rights which Americans and Wellesley students talk about. It provides the active participation that Wellesley should incorporate into its urban program.

Carol Bullard, '71 works in the Head Start program, but does not see herself as an activist:

"I love the kids in my class.

"I see them as individual personalities with curiosity, creativity, and intelligence, and 'wonder' about life."

Urban involvement on the part of Wellesley students does not necessarily represent a grand desire to solve the problems of the urban society. It is a means of expressing concern for human beings and gives opportunity to see for oneself the problems and structures studied in the classroom. □

Astronomy (from page 21)

dinary, Extraordinary. All for young ladies." Then putting his monocle on for a close survey, he asked "But what are their chances?"

The chances were really excellent in those days. Many doors were open to women which had always been locked. The roads were not crowded. Will you hear a few statistics? First as to woman's most important vocation. Just one-half of the 59 members married.

As an illustration of our *chances* may I say a few words on the subject best known to me, Astronomy. In the 80's and 90's this ancient science was undergoing the greatest transformation since the invention of the telescope. The photographing of the sky, experimented with for half a century was becoming a reality, and simultaneously came the deciphering of the meaning of the dark lines in the spectrum of the sun and other stars.

There began to come the fulfillment of man's longing through the countless ages to know something of the very nature of the Universe.

Wishing to attempt to be an astronomer—and encouraged by Alma Mater with some groundwork in physics and mathematics . . . this member of '84 was fortunate to fall under the leadership of Edward C. Pickering at Harvard Observatory. He was a pioneer in new methods for this old science and also was a firm believer in woman's ability to do astronomical work, especially since photography transformed it into a daylight profession.

Influenced by Professor Whiting's great interest in the subject of analysis of light, the spectra of the stars appealed to me, and I ventured on the problem of classifying some southern stars whose spectra had been photographed in Peru. It was a novel undertaking, being done at almost no other observatory at the time. When the first Memoir was published we looked over all the journals to see what criticism there might be. Not even mentioned! Absolutely no interest in the subject. Our work was ignored. No other astronomer knew enough or cared enough to review it. It was rather chilling, but we went on.

It did not take long before the apathy in astronomical circles had vanished entirely, for that which was described as a pleasing pastime in the 90's has now become the most popular branch of astronomy to which the greatest telescopes are devoted.

For it was learned that the deciphering of the dark lines in stellar spectra can be made to tell not only what the stars are made of, but also the story of the star's motion, temperature and many other things, even its distance. Thus arose a world-wide (astronomically speaking) desire for this knowledge of which there was no complete record on the earth except on the Harvard photographs.

In 1908 I had the pleasure of getting acquainted with those picturesque characters, Sir William and Lady Huggins in London. Sir William looked at me rather pityingly and said "It's nothing now. You ought to have been at work in the 1860's when nobody knew what a star was made of." Nothing in 1908! Just before Bohr on atoms, before Einstein's theory of relativity, before the great telescopes revealed the nature of the spiral nebulae, and doubtless greater advances still to come!

We in our day had little specialization. All of us had to take Latin, French, mathematics, all had junior physics, but wasn't there some element which taught us to fit into different conditions of life? If our Wellesley training is such as to teach us adaptation to whatever may come (and no one can forecast what it will be), whether it be marriage or teaching, farming or doctoring, if it be such as to enable us to balance this life of ours properly and find joy in our pilgrimage, perhaps after all it makes little difference whether we are of the class of 1884, 1909, or 1934.

If I have bored you, pardon.

"Naught falls so silent as the foot of time.
Hence we mistake our autumn for our prime." □

Chinese (from page 11)

ing from left to right and top to bottom, and only a well-trained talent can create them with real artistry.

In the academic year 1968-69 Mrs. Monica Chen Yu was appointed Teaching Associate to assist Mrs. Lin. Twenty-five students were enrolled in the courses, some of them on the M.I.T. exchange program. Last February ten of them sang

had joined with the French Fleet to challenge Great Britain in its supremacy of the sea. The fate of Great Britain and almost of the English-speaking people for perhaps a century, was at stake. Lord Nelson had retired from his command as admiral of the English Navy, but all hearts turned to him again for leadership. He again donned his uniform and took command. As he sailed forth to meet the combined fleets of the enemy, and as his ships were drawn up in battle array, he used his code and wagged this inspiring and historic message to the men under his command: "Today England expects every man to do his duty." The battle proceeded, of course, and the God of battles fought with Nelson, and a great victory was won. Today our great leader and commander says to free men of America, "In this hour of great crisis, the Nation expects every man to do his duty," in the air, on land, and on sea.

Are we willing to pay the price to preserve our inheritance—that "Government of the people, by the people, and for the people, shall not perish from the earth"?

The Late Dr. Annie J. Cannon

EXTENSION OF REMARKS
OF
HON. JAMES H. HUGHES
OF DELAWARE
IN THE SENATE OF THE UNITED STATES

Tuesday, April 15, 1941

ASSOCIATED PRESS ARTICLE

Mr. HUGHES. Mr. President, I ask unanimous consent to have printed in the Appendix of the RECORD an account of the life, death, and services of Dr. Annie Jump Cannon, who in 1929 was listed by the National League of Women Voters as one of the 12 greatest living American women.

Dr. Cannon was born and raised two doors from where I reside in Delaware. I knew her very well in her girlhood days, and later, on her many visits to her home in Dover. Dr. Cannon was a great astronomer—in fact, one of the greatest the world has produced. She is credited with having classified over 400,000 stellar bodies. At the time of her death she was engaged in the work of her lifetime at Harvard Observatory. While I stood in awe of her profound learning, I greatly admired her for her simplicity, kindness, and cheerful outlook. Like others who knew her as a friend and neighbor, I loved her.

There being no objection, the article was ordered to be printed in the RECORD, as follows:

DR. ANNIE J. CANNON, NOTED ASTRONOMER, DIES AT AGE OF 77—SCIENTIST AT HARVARD CLASSIFIED MORE STARS THAN ANY OTHER PERSON

(By the Associated Press)

CAMBRIDGE, MASS., April 14.—Death has ended the career of Dr. Annie Jump Cannon, 77, world-famed Harvard astronomer, who refused to give up her work even though she had been officially retired.

The gentle, silver-haired scientist who had classified by their spectra more stars than any other person in the world, died last night at a hospital from a sudden relapse of a month-long illness.

She was retired by Harvard last September, after 44 years of service, because she had attained the compulsory retirement age. She had been working at the Harvard observatory on a special astronomical mission from Yale up to a few weeks ago.

In her life work at Harvard she was credited with the classification of almost 400,000 stellar bodies according to their spectra.

DISCOVERED 300 VARIABLE STARS

She also was the discoverer of more than 300 variable stars, 5 novae, and 1 spectroscopic binary, or double star.

A native of Dover, Del., she was interested in astronomy as a child, and made observations with the aid of a smoking candle from a candelabrum, which even today rests in the living room of her tiny residence—Star Cottage—close by Harvard Observatory.

She was the first woman ever to receive an honorary doctor's degree from Oxford University and was the first woman ever to be elected an officer of the American Astronomical Society.

In 1929 she was listed among 12 "greatest living American women" chosen by the National League of Women Voters.

WON HENRY DRAPER MEDAL

Her greatest single achievement was the classification of a quarter of a million stars to make up the famed Henry Draper catalog for international use—a work that won her the Henry Draper Medal of the National Academy of Sciences in 1931.

Miss Cannon since has worked on the extension of that catalog, and in her most recent work for Yale was engaged in a "wholesale" classification of stars in a selected zone extending all around the heavens.

A graduate of Wellesley in 1884, she came to Harvard as an assistant in 1897.

She was stationed at Harvard Observatory in Arequipa, Peru, for a time, and in 1911 became curator of astronomical photographs at Harvard. In 1938 she was named William Cranch Bond astronomer.

St. Lawrence Waterway

EXTENSION OF REMARKS
OF
HON. HARRY FLOOD BYRD
OF VIRGINIA
IN THE SENATE OF THE UNITED STATES

Tuesday, April 15, 1941

MEMORANDUM BY H. E. KETNER, COMMERCE COUNSEL OF THE VIRGINIA STATE CORPORATION COMMISSION

Mr. BYRD. Mr. President, I ask unanimous consent to insert in the Appendix of the RECORD an able document prepared by Mr. H. E. Ketner, commerce counsel of the State corporation commission of Virginia, in opposition to the proposed St. Lawrence waterway. The opinions expressed by Mr. Ketner are endorsed by the entire State corporation commission of Virginia, composed of Hon. Thomas W. Ozlin, chairman; Hon. H. Lester Hooker; and Hon. William Meade Fletcher.

There being no objection, the document was ordered to be printed in the RECORD, as follows:

COMMONWEALTH OF VIRGINIA,
STATE CORPORATION COMMISSION,
Richmond, March 27, 1941.

Memorandum to the Commission:

This refers to the St. Lawrence waterway project which is now pending in Congress.

I have read and studied several pamphlets and surveys made by various parties respecting this proposed project. Even though it is stated in a survey made in 1940 under the direction of Hon. Jesse H. Jones, Secretary of Commerce, that "every national administration since the time of President Woodrow Wilson has been in favor of proceeding as expeditiously as possible with plans to construct a seaway for oceangoing vessels from the Great Lakes to the Atlantic," and "President Coolidge and President Hoover were particularly active in promoting the cause of a seaway," and "the new administration which took office in 1933 was equally desirous to see the seaway constructed," I am unable to see that the project would be beneficial to this country. I think it would be most unfortunate to undertake a project of this kind at the present time when all of our efforts, cash as well as skilled labor, are urgently needed for national-defense purposes.

There appeared in the March 26, 1941, issue of the Richmond News Leader an article headed "Defense needs to hold up last leg on James (River) project." The article read, in part, as follows:

"The projected completion of the last leg of the 12-year project for straightening and deepening the James River channel below Richmond gave way tentatively to national-defense measures today when the War Department notified Congress that no new rivers and harbors work could be undertaken in Virginia during the fiscal year beginning July 1."

Testimony had been submitted by Public Works Director Gamble Bowers that the completion of the James River project was considered essential to the preservation of the river for large ships. In the annual report of the Chief of Engineers, recently sent to Congress, it was stated that $280,000 profitably could be expended during the year for the James River improvement, but it was excluded because of national-defense needs. From the beginning of the advocacy of the St. Lawrence waterway project, more than four decades ago, transportation was given as the principal benefit to be derived from the construction of the project. If the defense needs are to hold up the last leg of the James River project, the value of which has been demonstrated, certainly the same needs should preclude the beginning of the St. Lawrence project which would be, to say the least, of doubtful value.

Even the advocates of the project do not contend that it would be beneficial to the States located along the Atlantic Seaboard, including Virginia and the other southern, southwestern, and western States. It is stated in a pamphlet recently released by the National St. Lawrence Project Conference, of Washington, D. C., that 85 percent of the cost of the project to the Federal Government would, in all probability, be paid by taxes collected from those living in an area which would receive no benefits and would even be damaged by its construction. Virginia, with her coal mines, large and important coal-carrying railroads, important ports, shipbuilding facilities, etc., falls within the latter category. That is, taxes would be collected from Virginians to help build a project that would be peculiarly harmful to the State. I have in mind particularly Virginia's ports, coal-carrying railroads, coal operators, and shipyards.

During the year 1940 coal dumpings at the Hampton Roads ports amounted to 19,941,874 tons. More than 16,000,000 tons of this traffic was coastwise movement, principally to New England, and approximately two and

STAR COTTAGE
4 BOND STREET
CAMBRIDGE, MASS.

February 19, 1928.

My dear Mrs. Krazer, It was so kind
of you to send us that big can of
R. and R. Cream, of which I am very
fond, and have been unable to locate
in Boston for a year or more. I like
it also especially for Sunday evening
supper when friends come in, which
happens very often. They told me another
brand at S.S. Peirce's in Boston,
but it was not nearly so good.

I hope the R. and R. will soon get back to the general market.

We had our first big snow-storm yesterday, a wet, clinging type, and the view is glorious this morning. Sky a deep blue, while the big trees in our garden and every bush are draped in white. The air is so invigorating, too. I love clear cold weather.

I hope all goes well with Elizabeth at Mt. Holyoke. A little bird told me she did well in Astronomy.

It must be lovely out there this morning, with the white mountains in sight.

I am enclosing a little starpicture. It is called the North American Nebula, from its resemblance in shape to North America. It is made up of hosts of stars, and gaseous matter.

With kindliest greetings to Mrs. Mayer, and again many thanks and hearty appreciation for your useful gift to us,

Very cordially yours,

Annie J. Cannon

The North American Nebula
in
the Constellation
of
Cygnus

From
Miss Annie Cannon

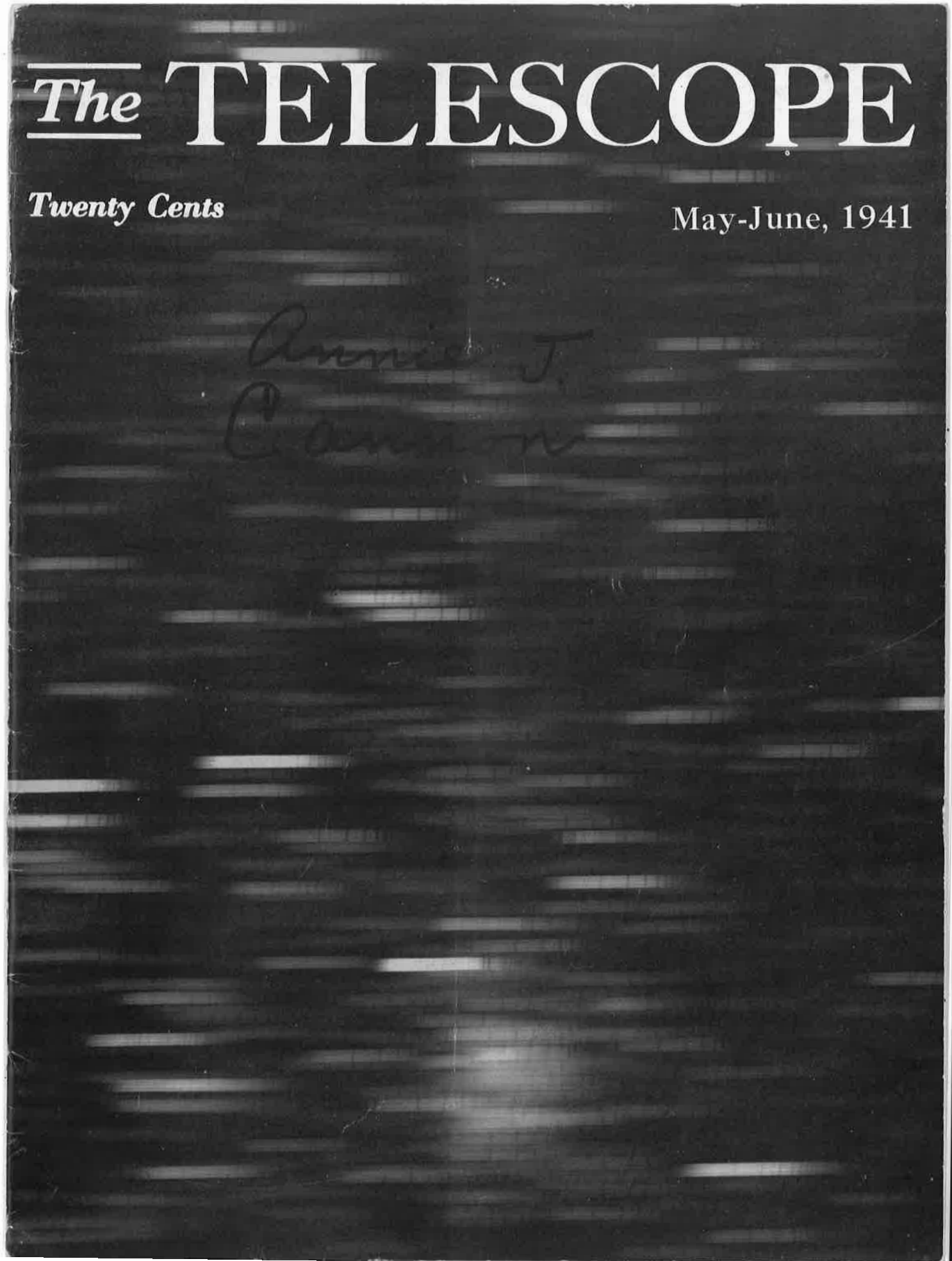
CAMBRIDGE A. MASS
FEB 21
8—PM
1928

Mr. Harry Mayer,
Dover,
Delaware

The TELESCOPE

Twenty Cents

May-June, 1941



ANNIE JUMP CANNON
Doctor of Science

Return to Mark L Ridgely.

IN MEMORIAM

Miss Annie Cannon, to honor whose memory we are gathered in this simple ceremony, was a multiple person; and in each of her various personalities she was a resplendent example—an illustration in a world that needs comfort and inspiration of just how good mankind can be.

I first refer to the Miss Cannon who was a scientific authority, not because that phase of her activities outshone other phases, but the recorded results of her authoritative scientific statements may be more imperishable, and will become, as the years go by, less diffused and vague than will the other facets of her existence, which survive chiefly in our memories.

Universally acknowledged as authority on the spectral classification of the stars, she built for the future more than for her contemporaries. Her forty years of devotion to one field of science enabled her to erect a scientific castle in which man's imagination long can dwell—a structure that probably will never be duplicated in kind or extent by a single individual.

In some ways Miss Cannon's great catalogues of the spectra of stars represent not only her devoted service to science and to man's intellectual yearnings, but also her service to the stars themselves. It is not given to many to serve as she did as the personal ambassador for hundreds of thousands of individual stars—to represent such a great portion of Nature's realm, filled with its inanimate but nevertheless throbbing starlife.

Though rigorously scientific in her attitude toward her analyses of stellar spectra and toward the surveying of the skies, nevertheless Miss Cannon had a personal friendly interest in these remote gigantic gaseous spheres, which came before her vision as images on photographic plates. She did not like to have a star left out of her catalogue, with its spectrum, its temperature, its composition unrecorded for man's study, just because the spectral image on her photograph was defective, or was confused by neighboring stars. No, to such objects, to such temporarily underprivileged stars, her natural sympathy seemed to go out, with the result that more photographs were demanded, more efforts made to give all stars a fair and equal treatment. She was indeed their faithful representative.

Miss Cannon's great catalogues are frequently referred to as the bible of modern astronomy; and these massive tables do have the appropriate inspiration to justify that naming, and the power to guide the seeker after universal truth.

In the past two or three decades many astronomers have come to the Harvard Observatory to learn Miss Cannon's methods; not so much because the procedures are complicated; not so much that various criteria, different from Miss Cannon's, could not be set up and used constructively, but because, by common consent, it is best for anyone who classifies the spectra of faint stars to be standardized against Miss Cannon, to be homogeneous with respect to this Harvard system.

Less distinctly, perhaps, but more humanly, another phase of Miss Cannon's personality will long live in America. She must be classed among a group of pioneer women scientists. Most of her fellow pioneers were largely engaged in educational projects; she worked on the creative side of the great process of understanding. Her persistent activity has been a guiding light to women scholars. Her success has been their inspiration.

The many academic and scientific honors that have come to Miss Cannon have never been envied by her colleagues in scientific work, for all must have felt: "This is a recognition of us all, of our ambitions, of our cause, and we are happy that this recognition is bestowed on an individual we so much respect and love."

It may be written down some time that great as has been Miss Cannon's scientific contribution, her highest distinction has been her personal example. For to both men and women colleagues her diligence, her quiet and cheerful excitement about her work, her remarkable faithfulness, and her loyalty to her science and to the stars, have been spiritual catalysts. Certainly with such an example we cannot permit to flag our own excitements and our own endeavors.

But to many of her friends here assembled, and to countless others in America and abroad, it is Miss Cannon the rare being, replete with human interest, that will be recalled with reminiscent pleasure, and whose passing will be mourned as a serious personal loss.

Miss Cannon loved little children and all their experimentation with a developing world; she admired school boys, and young men and women, both when they were seriously playing and when playfully working; she was deeply interested in growing families and the human perturbations of parenthood. Elderly people appealed to her greatly, and she was a most devoted friend, throughout the last years of her life, to those who had grown old along with her. In other words, from the cradle to the fourth score year, at every stage, she was intensely interested in humanity; and without exception the individuals of all the stages responded to Miss Cannon's personality. A children's party at Star Cottage, a Class Reunion at Wellesley, a meeting of the International Astronomical Union, a dinner of the American Philosophical Society—all these found Miss Cannon alive with interest, and found her making her unique contribution of vibrant personal charm.

As a pure scientist, as an inspiring leader of women scholars, as a human companion, Miss Annie Cannon led a long and happy and useful life. It is an honor to all of us here that we can memorialize that life with this, our simple ceremony.

From Harlow Shapley's remarks at the memorial services for Miss Cannon.

Miss Cannon with Prof. Schlesinger of Yale and Prof. A. S. Eddington at the Paris meeting of the International Astronomical Union, 1935.

Miss Cannon with Dr. James B. Conant, President of Harvard University.

A children's party at "Star Cottage."

The Story of Starlight*

BY ANNIE J. CANNON

GOOD AFTERNOON, Ladies and Gentlemen:

It is a pleasure to speak of such an interesting subject on this winter afternoon when our star, the sun, is giving us in this northern locality a little more daylight and when so many brilliant stars shine in our evening sky.

May not in truth astronomers be likened to the Utopian "brethren of light" "who maintain a trade not for gold, silver, or jewels, nor for silks, nor for spices, nor for any other commodity of matter, but only for God's first creation which was Light." Light coming through space with the marvelous velocity of 186,000 miles a second, brings all the evidence we have of this great stellar universe. Light, whose radiations are unchanged whether but 8 minutes on the way, as from the sun, or millions of years as from distant galaxies, also brings to us knowledge which fifty years ago seemed almost beyond human thought. *Patient light!* Shining down on humanity these countless centuries until man became clever enough to wrest from its vibrations the secrets so closely concealed.

We can trace back the beginning of this new astronomy to 1666 when Isaac Newton bought at a country fair a crude prism, "to try therewith the phenomena of color." By many experiments he proved that light is a heterogeneous mixture of differently refrangible rays. Since there was no English word to designate the beautiful band of multicolored rays produced by his prism, he took from the Latin the word *spectrum*, meaning an appearance. No word is heard more often in modern astronomy than this word *spectrum*. No starry appearance is more eagerly sought.

Newton did not fail to realize the importance of his experiments, for thus he reported to the Royal Society his new Theory of Light and Color: "It is in my judgment the oddest if not the most considerable detection which hath hitherto been made in the operations of Nature."

Odd, indeed, it did seem to the thinkers of that day, for Newton was persecuted by criticism and discussion. Even as late as 1790, the poet Goethe, who aspired to be a scientist, considered that "the idea of white light being composed of colored lights is quite inconceivable, mere twaddle, admirable for children in a go-cart."

It was actually 200 years before Newton's work was carried to fruition, and then those magical dark lines which traverse the spectra of all stars were forced to yield secrets enough to fill many chapters in the Story of Starlight. With the interpretation of the meaning of dark lines in stellar spectra, a new field of human thought and endeavor arose. Various astronomers be-

* One of the series of radio talks *Harvard Observatory on the Air* given over station WRUL, Jan. 18, 1941.

gan to supplement their telescopes with an instrument which by some such device as a wedge-shaped piece of glass, a prism, separates light into its component colors. The Italian astronomer, Father Secchi, observed the spectra of a large number of stars and placed them in four great classes. William Huggins, of London, assisted by his gifted wife, studied in detail some of the brighter stars. There was not at that time any method of distinguishing between a gaseous nebula and a cluster too distant for existing telescopes to resolve into stars. It was not even known that gaseous clouds existed. One of the early triumphs of Dr. Huggins came in 1864 when he looked at the spectrum of a small nebula and found to his astonishment that it was not at all like that of a star, but only a bright line, proving the object to be not an aggregation of stars, but a luminous gas.

Meeting Sir William and Lady Huggins in London nearly 50 years after this discovery, I was delighted to hear them recount the joys of being astronomers in the 1860's when nobody knew what a star was made of. "Those were the days," said Sir William, "when there was something worth while to do in astronomy."

All honor to those pioneers who accomplished so much from their visual observations of stellar spectra. For the human eye is not sensitive to a large range of color, and much of the blue end of the spectrum is produced by rays of wave-lengths too short to be seen visually. But another development was close at hand. Chemists were busy mixing bromides and gelatines that were destined to change the whole method of astronomical research. Celestial photography had been started at Harvard on Daguerreotype plates as early as 1850, and by the wet collodion process in 1857, but had been abandoned because of the slowness of the films. In 1882, when dry plates were available, astronomers were quick to recognize their value. The successful impression of the Great Comet of 1882 on such a plate in South Africa caused Sir David Gill, Her Majesty's Astronomer at the Cape of Good Hope, to commence the photography of the southern stars. Dr. Henry Draper of New York succeeded in photographing the spectrum of Vega, showing the dark lines of hydrogen. Edward C. Pickering, then Director of Harvard College Observatory, commenced to experiment with lenses, and dry plates so that by 1885 he had started in earnest the great Harvard photographic collection of celestial objects.

Excellent star spectra dating back to 1885 may now be seen on Harvard plates, films still unfaded. Professor Pickering's interest never faltered, and the photographic telescopes were never idle on good nights. His successor, the present Director, Dr. Harlow Shapley, has continued with the same zeal so that the Harvard photographic collection now contains 500,000 negatives, which may be likened to a library of first and only editions, the whole forming the sole record of events occurring in the stellar universe for the last half century.

A southern Harvard station was es-

tablished in Peru in 1891, first on an unnamed mountain above Lima, which was christened Mt. Harvard, and later at beautiful Arequipa where many thousand photographs of southern stars were obtained and sent to Cambridge, Massachusetts, for study and storage.

Every astronomer should at some time in life see the whole sky. So when the opportunity came to me to go to the Arequipa station, it was a glorious experience to sail over equatorial seas into Inca Land and see a new heaven and a new earth; to live amid the wonders of an unknown past, for the Incas left no written word; to be situated 8000 feet high, away from electric light and fog. The sky so strange and different was overarched by the great southern Milky Way, with its far-famed Cross, and contained those fleecy Clouds of Magellan, so near the south pole as not to be visible from any point of our own land.

In that sky, the Southern Cross is the most famous, popularly; the Clouds of Magellan, the most important, astronomically. The Southern Cross, although not very large or very bright, is a beautiful asterism near the great star clouds of Carina. Its usefulness to the early navigators in pointing to the South Pole, which has no polar star to guide mariners, together with their joy in recognizing the emblem of their faith in the sky, gave it at once an enduring fame.

The Clouds of Magellan, the Large and the Small, appear to the eye like misty portions torn off the Milky Way. It was with a feeling of awe that I gazed upon those Clouds for the first time, while my mind reverted to the many problems their multitude of stars had presented to us on the Harvard photographs.

They are the nearest of all the external galaxies, other universes, of which we have any cognizance. Really, the Large Cloud is only 85,000 light years away! Among the stars of these Clouds, there are many of great interest—perhaps the spectrum contains bright lines, or is of an uncommon type, or indicates enormously high temperature. Anything unusual about a star is exciting to an astronomer.

With the success of the photographic method, the old science of astronomy became a daylight profession, for one may see more by examining a photographic plate with a magnifying glass than by sitting up all night with eye at the telescope. Thus naturally astronomical research has a greater appeal to women than ever before. There is hardly an Observatory in these latter days without a corps of women assistants.

The Magellanic Clouds have furnished some exciting, exhilarating research to the women observers of Harvard Observatory. Miss Leavitt, about 35 years ago, discovered 1800 variable stars among the faint members of the two Clouds, and 500 additional ones have been found by later observers. The fact of the existence in another universe of these pulsating stars, which are Cepheid variables like those in our Milky Way system, is of great interest. The fact that the time of brightest light, the maximum, and of faintest,

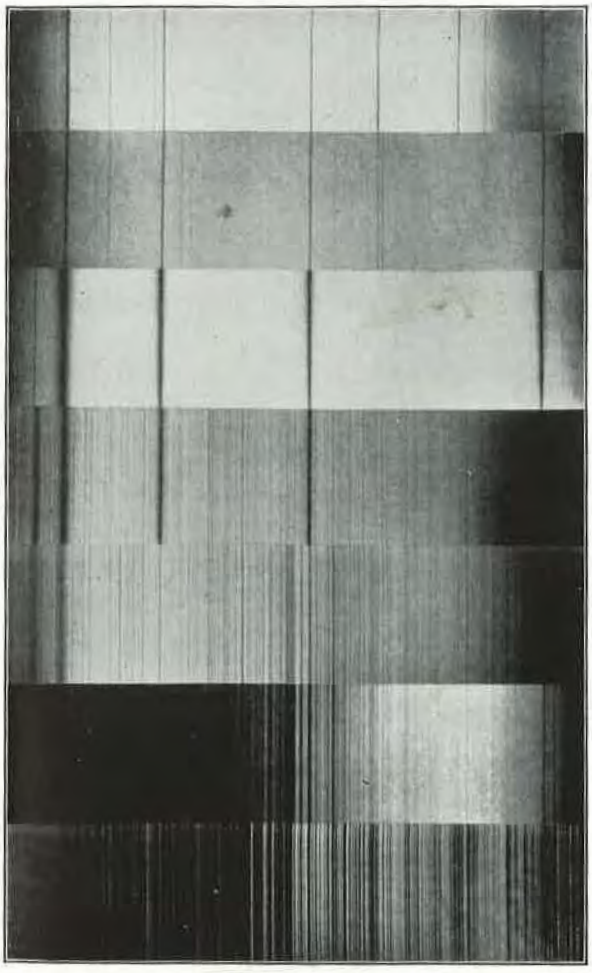
the minimum, can be predicted and observed, just as in our own system, is even more interesting and important, for it furnishes one of the various astronomical proofs that the same laws prevail throughout the universe.

But who would ever have dreamed that these pulsating stars held a secret which would yield a measuring tape for celestial objects, no matter how far away! The *period of variation* proved to be an index to the true luminosity of the star, its candle power. From its candle power and apparent brightness, one may readily calculate the distance. As Cepheid variables are numerous and scattered widely throughout space, this law is constantly used in determinations of the scale of the universe.

The harvest of discovery of peculiar and interesting celestial objects began with the first inspection of Harvard photographs. Let us note a few of these early discoveries. First, on December 11, 1885, the spectrum of the famous variable star, Mira, showed the hydrogen lines to be bright, which gave the first knowledge of this characteristic of long-period variables, and led to the detection of hundreds of similar variable stars. It may be added that by various methods, more than 10,000 variable stars have been discovered by means of the Harvard photographs.

Again, on November 3, 1887, the first photographic Nova, V Persei, appeared on a Harvard photograph, and since that time the plates have yielded 45 more. Doubtless many others are yet undiscovered among the great star clouds of the Milky Way.

Just one other instance of an important early discovery. On September 8, 1887, when there was much skepticism as to photographic evidence, and differences in the width of spectral lines was considered improbable, the spectra of Deneb, having very narrow lines, and Altair, with wider hazy lines, were photographed on the same plate to show such an appearance to be real and not due to the "vagaries of a negative."



The Harvard spectral sequence. The spectra shown are types: O, B, A (Sirius), F, G (the sun), K, and M (Antares).

As soon as a sufficient number of photographs had been secured, a sorting and classification was begun by Mrs. Fleming, so that as early as 1890, a catalogue of more than 10,000 stellar spectra was published. It was attempted merely to place all similar spectra together in groups designated by letters of the alphabet, for little was known of stellar evolution. Thus the A stars were those in whose spectra the lines of hydrogen predominated, as, for instance, Sirius and Vega; the G stars were of the solar type, as Capella; while M stands for red stars, as Betelgeuse. Photographs of larger dispersion, showing greater detail, were used by Miss Maury in her classical study of the brighter stars, with results published in 1897.

For some years, little interest was shown in the subject of the classification of spectra, but about 1905, astronomers generally began to realize that the class of a star's spectrum is a fundamental fact, closely linked with other physical properties of the stars, such as motion, temperature, effective age and even distance. Rather suddenly, it seemed, the class of spectrum became fashionable in astronomical circles. Makers of any sort of star catalogue, even the Nautical Almanacs, decided that inclusion of the spectra would be of value. Hence requests for the spectra of various lists of stars were constantly being received at the Harvard Observatory, since such information was not available elsewhere.

It was thus decided to select the best plates over the whole sky and make a general survey, including all stars for which the class was clearly indicated. "A census of the ether," this plan was called by Professor Turner of Oxford, for just as in the Roman census, each citizen was assigned to his proper class and tribe, so each citizen of the sky, sufficiently bright, was given its proper place in the archives of the heavens.

By the time the whole sky from the North to the South Pole was covered, 225,300 stars were enrolled in about 40 classes of spectra. The results filled 9 large volumes of the Harvard Observatory Annals. The classification of such a large and varied assortment of stars "furnished proof," to quote from the minutes of the International Astronomical Union, "that the spectra of nearly all stars can be arranged in a continuous sequence differing almost imperceptibly from one another." The interest in the subject had become so great that many astronomers could not wait for publication, so that lists of spectra were made out from the copy and sent to other observatories or to isolated investigators.

Following the publication of the final volume of this catalogue in 1924, even fainter spectra were wanted by astronomers ever peering into more distant corners of the universe. Could we furnish them? Better instruments together with plates of more sensitive emulsions were proving successful in showing fainter spectra, so why not give them to those who could use them to increase human knowledge?

Astronomers form a true international brotherhood. Therefore, the Har-

vard photographs have been searched to furnish much information now incorporated in catalogues of several American observatories as the United States Naval, the Yale, and the Dudley, as well as the Royal Observatory at the Cape of Good Hope.

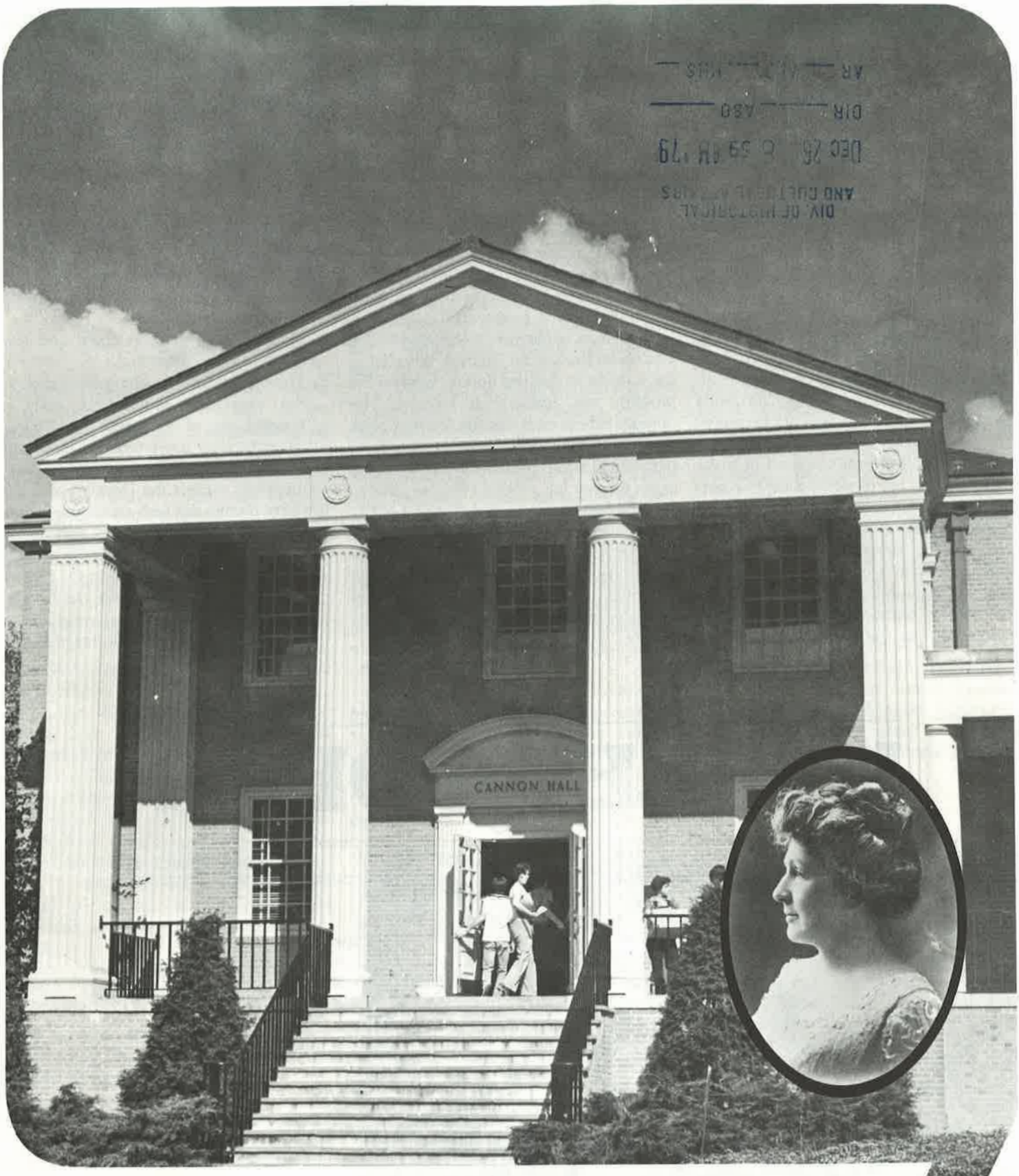
Friendly relations have been fostered by an International Astronomical Union which has met every three years since 1922 in various countries as Italy, England, Holland, America, France, and Sweden. The meeting for 1941 was scheduled to be held at Zürich, Switzerland, but alas! internationalism is now out of joint. These gatherings have formed delightful occasions for interchange of ideas, division of problems, and united discussion of all sorts of astronomical activities, mingled with social events characteristic of each country, the only drawback being that confusion of tongues which occurred at the Tower of Babel.

Thus "this arch of the sky, embracing all our lives" becomes a basis for genuine friendliness among those who gather the Story of Starlight, and sometimes others also, as evidenced in a letter once received at this Observatory from an unknown correspondent. The letter started in this way:

> "Very dear Professor:
>
> "Excuse me for addressing you so familiarly, but anyone who loves the stars is my friend whether he wants to be or not."

Similarly I visualize the listeners to this talk (if perchance there be any) as star lovers and friends, for otherwise the index of your radio would have been turned some minutes ago to another program.

Thus star lovers and star gazers are linked together in bonds of friendship while the same sky overarches us all, and we do our best to increase the sum of human knowledge as pertains to the Story of Starlight.



WESLEY TODAY

October, 1979 A quarterly publication for the alumni and friends of Wesley College, Dover, DE 19901

Annie Jump Cannon, Class of 1880

by Ethelwyn Worden
Director of College Relations

Wesley College's most famous alumna, Annie Jump Cannon of Dover graduated from what was then the Wilmington Conference Academy in June of 1880, imbued with a love of astronomy learned from her mother. The Delaware native went on to Wellesley and Radcliffe Colleges in Massachusetts for undergraduate and graduate study in a time when too much education was supposedly bad for a woman's health, and joined the staff of the Harvard Observatory. Her work at the Observatory, in the classification of stars, led to worldwide fame and recognition before her death in 1941.

In this centennial year of her graduation from the Academy in Dover, a series of projects is planned to call attention to Miss Cannon, and to her work in astronomy as well as in promoting the continued opening of positions for women in scientific fields, and women's suffrage in general.

Two students of history professor Allen Clark elected to study Annie Cannon for a project for his course this semester. Sherry Redd, a freshman from Richmond, VA, has scouted much information in Dover and has visited the Mt. Cuba Observatory near Wilmington, Delaware in her search to understand the Draper classification system of stars' spectra, used by Miss Cannon in her monumental work.

Valerie Buchman, a senior from Dover, traveled to Cambridge, Massachusetts one October weekend to keep appointments at Harvard College, Harvard Observatory and Wellesley College in her research on Annie Cannon as a person active in the period of development of professions for women.

The Mt. Cuba Observatory, as Sherry Redd discovered, was founded in Annie Cannon's memory, and a special fund endowed by the trustees of the Observatory and named for Miss Cannon, provides a scholarship at the University of Delaware for a graduate student in astronomy.

Sherry was also able to look through the Draper Catalogue, containing Miss Cannon's work, and to see exactly how the classification was made possible through use of a prism inside a photographic telescope. The resulting plate would show not dots of light where stars should appear, but that light broken down into a spectrum which, when analyzed, would tell exactly what elements (gases, metals) were found in each star. This in turn would permit Miss Cannon to accurately gauge the star's age, distance from the sun or earth, speed and direction of movement, among other information.

In her life Annie Cannon classified close to 400,000 stars, a monumental job, but one which secured for her many honors including honorary doctorates from six colleges including the University of Delaware, University of Groningen in Holland, and Oxford University, where she was the first woman to be honored with a doctorate of science. She also became, in 1931, the first woman to receive the Draper Medal of the National Academy of Sciences, in this country.

A candelabrum with prisms in her home in Dover fascinated the very young Annie, who loved to see the many rainbows created by light shining through the moving glasses. Her fascination with the color spectrum seemed a harbinger of of her later work, and she kept that candelabrum with her throughout her life.

Valerie Buchman found the candelabrum in the home of Margaret Mayall, Miss Cannon's assistant at the Harvard Observatory and a current resident of Cambridge, Mass. Mrs. Mayall inherited Annie Cannon's scrapbooks, photo albums, notebooks, correspondence, diaries, papers and miscellaneous memorabilia dating back to the last century, and was instrumental in helping to create an Annie Cannon exhibit at Harvard's Pusey Library in the 1978-79 academic year.

Having a wealth of personal information about Miss Cannon, with whom she had worked for many years, Mrs. Mayall was able to answer many of Valerie's questions and to show her pictures, papers and other materials which she could use in her research. Further questions about her work in astronomy and the Harvard Observatory and its southern hemisphere station in Peru, where Cannon went to observe and classify stars in the southern skies, were answered by Barbara Welther of the Harvard-Smithsonian Center for Astrophysics at Harvard, who also provided copies of printed material which Valerie could include in her research and work.

From the work of these two students in and out of Delaware, and with the assistance of many people interested in Annie Cannon, will come an exhibit on the Wesley campus in the late spring of 1980 which will be ready by Alumni Reunion Day, and will stay in place through commencement.

Because Annie Cannon was interested not only in stars, but in the promotion of women in scientific professions, she was a popular speaker on the subject of women's suffrage, an advocate of women's right to vote, and completely modest about her own work.

"My success, if you would call it that," she once told an interviewer, "lies in the fact that I have kept at my work all these years. It is not genius, or anything like that, it is merely patience."

Another quotation deals with the skies: "In these days of great trouble and unrest, it is good to have something outside our own planet, or something fine and distant and comforting to troubled minds. Let people look to the stars for comfort and find solace as others have."

Valerie's and Sherry's projects, when completed will be cataloged and added to the collection of Cannon memorabilia in Delaware. And during the fall semester, too, a special forum of women speakers, women in the sciences, will be presented as the Annie Jump Cannon Forum on November 28. Open to the public, its subjects will deal with women and their professional roles in the sciences today.

Wesley College celebrated Annie Cannon's birth centennial in 1963 with presentations of special gold medals to seven women who had achieved fame in their professions. Cannon Hall, the science building, was named for her. And her curious and hardworking spirit continues to inspire successive generations of women who are pursuing careers in the sciences.

Each year Annie Cannon enjoyed sending special Christmas cards, often with photographs she had taken, to her friends. In 1925 her card included a plate showing the spectra of a random field of stars, and on one portion included "The Story of Starlight:"

Special thanks to Valerie Buchman, whose notes contributed much of the information in this article.

THE STORY OF STAR LIGHT.

Since 1882, with increasing skill, astronomers have been able to photograph star light in such a manner that the marvelous wireless message from the distant body may be deciphered. The light from the star is allowed to fall through a prism placed in the telescope and, thus magnified, is split up into a band showing its component colors, the red rays going to one end, and the violet to the other. This is the spectrum of the star. The photograph does not show the colors, but, what is more important, it does show the presence of fine dark lines, few in some spectra and numerous in others. These wonderful dark lines have become a veritable happy hunting ground for the modern astronomer. By comparing them with lines given by glowing substances in his own laboratory, he can determine that the same elements familiar to us on the earth also exist in the outermost star. By measuring the positions of these mysterious lines he can discover whether a star is approaching us or receding from us.

For years the whole sky from the North to the South Pole has been photographed systematically at the Harvard Observatory. We have studied in detail the lines of all the brighter stars, and have arranged the spectra in an orderly sequence, beginning with stars which appear to be "young" and very hot, going through all the stages to those which are "old" and cooler. In very recent years remarkable relations have been found to exist between the class of spectrum and other properties of the stars, such as their distances and motions. It is for this reason that astronomers engaged in various kinds of investigations wish to know the class to which the stars belong. At no other observatory is there material for this determination on such a large scale as at Harvard. It has therefore been my good fortune to make a classification of all the stars whose spectra are sufficiently clear on the Harvard photographs. The spectra of more than 200,000 stars have been studied. The results will help to unravel some of the mysteries of the great universe, visible to us, in the depths above. They will provide material for investigation of those distant suns of which we know nothing except as revealed by the rays of light, travelling for years with great velocity through space, to be made at last to tell their magical story on our photographic plates.

Annie J. Cannon

Delaware Biography

Cannon, Annie Jump 1863–1941

DEL. WOMAN FIRST OF SEX TO GET ACADEMY OF SCIENCE HONORS

E.J. 11/18/31 P.1 Del-B.

Henry Draper Award Given Miss Annie Jump Cannon, of Dover, for Her Catalogue of 300,000 Stars; Work Covers Nine Volumes; Men Have Always Won Medal in Last 45 Years

INDEXED

NEW HAVEN, Conn., Nov. 18 (AP). —Development of a girlhood fascination for gazing at stars from the attic window of her Dover, Del., home led Miss Annie Jump Cannon to one of the highest scientific honors here last night.

She was presented with the Henry Draper Medal by the National Academy of Sciences, the first woman to win this award for scientific achievement. The medal has been awarded to twenty men in the last 45 years.

Miss Cannon is an astronomer at Harvard Observatory. She went there as a young woman and has accomplished one of the most monumental astronomical tasks of all time.

She has catalogued more than 300,000 stars. The meaning of this may be understood by recalling that all the seeming myriads of visible stars number only about 5000.

Her catalogue is based on the spectra of the stars, which is a photographic analysis of the light of each of the vast host in her catalogue. This analysis shows whether the stars are composed mainly of one substance such as hydrogen, or of something else.

In the Henry Draper catalogue, where her work is printed, she recorded 225,300 stars. This covered every star in the heavens brighter than the eighth magnitude. The publication required nine volumes.

Since completion of this catalogue seven years ago, she has gone ahead with the still fainter stars, extending down almost to the twelfth magnitude. In these seven years, Miss Cannon has added another 100,000 star spectre.

MISS ANNIE J. CANNON

Of Dover, Del., who was honored by The National Academy of Sciences for her catalogue of 300,000 stars. It is the first time a woman has been so honored.

Her catalogue is used by astronomers all over the world.

Miss Cannon attributes her love of astronomy to her mother, who taught her to observe the night skies from the attic window. Her girlhood observations were done with the aid of a smoking candle to light her astronomical guide book of the stars.

BORN IN DELAWARE

Miss Cannon was born in Dover, educated in the Dover public schools and at the Wilmington Conference Academy of this town. The Draper catalogue of the stars has called her the foremost woman astronomer in the work. The catalogue has reported on her activities as follows:

E. J. 11-18-1931 : 1

(over)

Donated to the Dover Public library 6 November 1989
by

JEAN COFFEY ROW
207 ORCHARD AVENUE
DOVER, DELAWARE 19901

(Rec'd August 1989 from
Wilmington Institute Free library)

"In 1897 Miss Annie J. Cannon who has had general charge of the work of the classification of the stars in the Draper catalogue from the outset, first went to Arequipa to photograph the stars in the southern sky, and the results of her work were published, making a catalogue of 1122 stars.

"From 1911 to 1915 more progress was made on the catalogue, as the memorial collection by that time contained photographs of stellar spectra over the entire sky, and at present the work under Miss Cannon has reached a point where the catalogue is complete up to 195,000 stars.

"In Miss Cannon's office in the Harvard Observatory an immense library bureau card catalogue system keeps information about each star on file. Brought to earth by the telescope and camera, their physical make-up analyzed by the prism, their place in the heavens, accurately designated by charts drawn from the photographs of the different sections of the sky, all of the known facts regarding them thus tabulated, each star is pigeon-holed on its card and the cards, instead of being arranged alphabetically, are placed in the drawers in the order of the right ascension of the stars—right ascension being their position in the sky, corresponding, roughly speaking, in the mapping of the celestial sphere to the degrees of longitude from the meridian of Greenwich on the terrestrial globe."

(1)

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News 4/14/1941

ANNIE CANNON DIES; FAMOUS ASTRONOMER

Native of Dover Was Greatest Woman Star Scholar; 44 Years At Harvard Observatory

Classified Almost 400,000 Stellar Bodies; Honored By U. of D., Many Societies For Her Outstanding Work

By The Associated Press

CAMBRIDGE, Mass., April 13—Dr. Annie Jump Cannon of Harvard, most famous woman astronomer in the world, died tonight at a hospital after a month's illness. She was 77 years old.

Miss Cannon, who had been officially retired from Harvard last September, had been working at the Harvard Observatory on a special astronomical commission from Yale up to a few weeks ago.

In her life work at Harvard, she classified more stars than any other person in the world, being credited with the classification of almost 400,000 stellar bodies according to their spectra.

She also was the discoverer of more than 300 variable stars, five novae and one spectroscopic binary, or double star.

Native of Dover

A native of Dover, Del., she was interested in astronomy as a child, and made observations with the aid of a smoking candle from a candelabrum, which even today rests in the living room of her tiny residence —"Star Cottage"—close by Harvard Observatory.

(Miss Cannon learned first about the stars from her mother, who as a girl attended a Friends school which had a course in astronomy. With the information given her by Mrs. Cannon, the girl would climb into the attic of their home in Dover and through a trapdoor onto the roof, from where she would gaze through the limbs of the stately trees that surrounded the house at the heavens and pick out the constellations and larger stars.

(Before she left Dover to attend Wellesley College, she was well versed in an amateur study of astronomy. She also had taught herself the constellations from crude charts in an old astronomical book, most likely one her mother had used in school.

Candle Worried Father

(The tallow candle which she used in her attic study caused considerable worry for her father, Wilson Lee Cannon, builder of wooden ships and well-known politically in Dover before the Civil War. She had since remarked, "Father was more interested in the safety of the house than in the movements of the stars."

(She received her early education in the public school at Dover and at the Wilmington Conference Academy of that city. After her graduation from Wellesley, she spent the following 10 years at her home in Dover and then returned to college for advanced study in mathematics, physics and astronomy. She was a "volunteer assistant" in the research laboratory at Radcliffe before going to Harvard.)

She was the first woman ever to receive an honorary doctor's degree from Oxford University, and was the first woman ever to be elected an officer of the American Astronomical Society.

Among 12 Greatest

In 1929, she was listed among twelve "greatest living American women" chosen by the National League of Women Voters.

Her greatest single achievement was the classification of a quarter of a million stars to make up the famed Henry Draper catalogue for international use—a work that won her the Henry Draper medal of the National Academy of Science in 1931.

Miss Cannon since has worked on the extension of that catalogue, and in her most recent work for Yale, was engaged in a "wholesale" classification of stars in a selected zone extending all around the heavens.

A graduate of Wellesley in 1884, she came to Harvard as an assistant in 1897. She was stationed at Harvard Observatory in Arequipa, Peru for a time, and in 1911 became curator of astronomical photographs at Harvard. In 1938, she was named William Cranch Bond astronomer.

Stars Almost Spoke

In her cataloguing work, she determined classification by studies of thousands of telescopic photographs of the heavens, listing certain constituent elements of the stars through observance of their various spectrum lines.

"They aren't just streaks to me," she once said, "each new spectrum is the gateway to a wonderful new world. It is almost as if the distant stars had really acquired speech and were able to tell of their constitution and physical condition."

In her latter years, she often deplored the fact that women in science once were subject to ridicule.

Studies Were Shocking

"When one sees the crowds of careless and free college girls of today," she said, "it is hard to conceive of the time when mathematical or other scientific study by girls was so shocking to the conceptions of mankind that she must needs do all her study secretly at night with a candle by her bedside."

Preferring starlight to limelight, she spoke little of herself during infrequent interviews, but always put the accent on the role of women in general in the science of astronomy which she termed an international "diplomacy of the skies."

Solace in Stars

"We could but wish," she once remarked, "that the legitimate work of young women toward increasing our insight into the true nature of the stars and the physical laws of the universe could drive out the superstitious middleage belief in horoscopes and astrology which still besets the minds of so many women, even in this country."

It was her belief that the interchange of ideas among astronomers did much to promote amity among nations, but at the outbreak of the war in Europe in 1939, she said:

"In these days of great trouble and unrest, it is good to have something outside our own planet, something fine and distant and comforting to troubled minds. Let people look to the stars for comfort and find solace as others have."

She held honorary degrees from the University of Delaware, University of Groningen, Holland, Mt. Holyoke, Oglethorpe University, Georgia, and Wellesley, and was a member of many scientific societies.

She was one of the few honorary members of the Royal Astronomical Society of London.

"My success, if you would call it that," she once told an interviewer, "lies in the fact that I have kept at my work all these years. It is not genius, or anything like that, it is merley patience."

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