History

Chamberlin Observatory, located four blocks east of the University of Denver campus at the corner of South Fillmore Street and East Warren Avenue, has been an intellectual as well as a physical landmark of Denver during its more than half a century of existence.

Through the efforts of Dean Herbert A. Howe, a gift was obtained from Mr. Humphrey B. Chamberlin to build and equip the observatory which bears his name.

Although ground for the observatory was broken in 1888 and the building was completed in 1891, the telescope was not installed until 1894, having been on display at the World’s Fair of 1893 in Chicago.

An interesting, though sad, commentary on the construction of the observatory is that Mr. Chamberlin never realized the complete fruition of his dreams for the observatory because of his untimely death, at the age of fifty, only three years after the installation of the telescope.

Growth

As with all other major scientific endeavors, a certain amount of “growing pains” were experienced when the telescope was first put to use. Dean Howe had planned to undertake an extensive program dealing with double stars but an unsteadiness of the atmosphere, provoked by the proximity of the mountains, frustrated his efforts. A new program was then initiated in which Dean Howe charted over a thousand nebulae.

The First Director

The history of the Observatory, from the day its construction was assured by Mr. Chamberlin until 1926, is essentially an account of the life of Dean Howe, his researches, his accomplishments, and his disappointments. An even hundred books and articles, published in the file of scientific journals, are the milestones in the life of Dean Howe and the history of the Observatory.

On June 8, 1918, a total eclipse of the sun was scheduled to be visible from Denver. Months of preparations, carefully checked and rechecked, were completely wiped out by a cloud covering the sun’s disk during the crucial moments. This disappointment was probably the most severe blow ever suffered by Dean Howe during his long and fruitful career.

The Present Director

The present director of Chamberlin Observatory, Dr. Albert W. Recht, was appointed following the death of Dean Howe in 1926. The activities of the Observatory have been directed into four channels under Dr. Recht.

Four-fold Program

First, and perhaps foremost, the Observatory has conducted a program designed for community service by having a regularly scheduled visitors’ night each week. In addition extra groups are accommodated sometimes as often as five other nights of the week. Included in the program for visitors is a lecture which explains some feature of astronomy and the viewing of celestial objects through the largest telescope, a twenty-inch refractor. This program is a major portion of the director’s aim of making available to every person interested, a general idea of how the universe around us is constructed. In contrast to the idea that to understand astronomy, even superficially, a person must be versed in mathematics, these lectures are geared to hit the highlights.
of description and ignore the precise presentation which necessitates a knowledge of mathematical theory. The program may be summed up as a presentation of "Astronomy for the Joneses."

The second part of the Observatory's general program has been the scientific researches carried on by its staff. In general, these investigations have been in the field of celestial mechanics or, more exactly, orbit theory and computation. The major effort of the director has been an investigation of the motion of Comet d'Arrest. This research is still being carried on and will continue for some time to come. A number of other investigations have been carried out by the staff and published in leading journals since the present director assumed his duties. Among the most prominent of these were an investigation of the color of asteroids by Dr. Recht and an extended occultation program by Mr. A. W. Beck and Mrs. Caroline P. Beck, carried out on an entirely volunteer basis. During 1934 this latter program comprised one-fifth of the occultation work done by the astronomers of the world.

A third aspect of the Observatory's activities has been making available its equipment to qualified amateur astronomers of the Denver area for research work in their chosen fields. This policy has yielded fine results and is to be continued within the limits of the availability of equipment.

The fourth activity of the Observatory has been its use as a laboratory for the students of the University of Denver taking courses in astronomy which require the use of astronomical equipment.

As a public service for many years, the director of the Observatory wrote a weekly article for publication in a Denver newspaper in addition to his other duties.

Equipment

Buildings and Grounds

Beautifully landscaped Observatory Park, which surrounds Chamberlin Observatory, is a spacious two-square-block area maintained by the City of Denver as a recreational facility for University Park residents. Through the foresight of the men who selected the Observatory site, adequate space is still available for additional buildings whenever their construction becomes possible.

The two Observatory buildings are of massive red Colorado sandstone construction. The outer walls serve as supports for their delicately balanced revolving domes. An interesting sidelight on the construction of the Observatory buildings is that they are constructed independently of the deep piers which support the observing instruments so that building vibrations will not be transferred to the telescopes. Accuracy of time recording instruments which depends on a constant interior temperature is helped by the insulation provided by the extremely thick walls of the Observatory buildings.

The main Observatory building has on its first floor an office for the staff, a small library room, a small lecture room, a room for housing the observatory clock, and the meridian circle room. The second floor contains a small store room, living quarters for the custodian, and the dome room where the twenty-inch refractor is mounted and housed.

It is hoped that in the near future a gift or an appropriation will be forthcoming to aid in modernizing the interior of the Observatory and

Large and Small Observatories
installing a photographic darkroom. An adequately equipped darkroom will
make possible economical development of all photographs taken by Observa-
tory equipment. As a result the programs of asteroid and comet location
will be greatly facilitated.

In addition to the main Observatory building there is a small students'
observatory about two hundred feet southwest of the main building. This
building is, at present, undergoing renovation to prepare it for the mounting
and housing of the new twelve-inch reflector telescope and the eight-inch
Schmidt-type celestial camera.

Telescopes

Twenty-inch Refractor:  This telescope is the largest owned by the Observatory
and is the main instrument. Its objective lens with a twenty-inch diameter
was ground by Alvan Clark, the unparalleled lens-maker of the last cen-
tury, and cost $11,000. It could not be duplicated today for many times that
amount. At the time of its construc-
tion the telescope was the sixth largest
in this country. At present, it still
ranks among the largest refractors, be-
ing tenth in size. An interesting side-
light is that, with the exception of the
twenty-four-inch Lowell telescope at
Flagstaff, Arizona, it is today the
largest refracting telescope within a radius of one thousand miles of Denver.

From the early days of micrometric observations of comets and asteroids
to the present photometric work on eclipsing double stars, nearly all research
programs of the Observatory have been conducted with the aid of this great
telescope. It was around this instrument that the Observatory was planned
and built.

Twelve-inch Refractor:  This instrument is one of the most recent acquisitions
of the Observatory and is a gift from Mr. Clendon S. Walton, well-known
amateur astronomer of Denver and former volunteer research associate of
the Observatory. The Observatory is extremely fortunate in having the ser-
dices of Mr. Walton and Mr. Robert E. Glover, prominent Denver engineer,
for adapting the small observatory to accommodate the new telescope and
for designing and building a mounting for it.

It is planned to use this instrument ex-
tensively for photographic work in classes
in practical astronomy. The telescope's
main use will probably come in the photo-
graphic determination of positions of as-
teroids and comets. Much work will need
to be done on asteroids before informa-
tion about these small planets is organized
again as it was before the recent war.

Six-inch Refractor:  At present the six-
inch refractor is not mounted, having
been formerly mounted in the students’
Observatory. It is hoped that an addi-
tion may be built to the main Observa-
tory building in the near future so that
this fine instrument may be returned to
its former position and the twelve-inch
refractor may be moved to a new and
modern dome.

Photographic Equipment

Eight-inch Schmidt-type camera:  At the time that Mr. Walton gave the
Observatory the twelve-inch reflector, he also presented an eight-inch Schmidt-
type camera. The camera will be mounted "piggy back" with the twelve-inch
refractor in the small dome. The fine workmanship in both of these instru-
ments is amazing considering that they were constructed by a man who is
an astronomer only by way of an avocation. They compare favorably with
any commercially-made instruments.

The twenty-inch refractor and the twelve-inch reflector may both be
adapted to photographic work with a minimum of effort.

Photometer

The new photoelectric photometer, an instrument designed about an extremely
sensitive photo-electron multiplier vacuum tube, will be used for research on
the problem of eclipsing double-star systems and an investigation of the
so-called dark areas of the sky.
**Blink Microscope**

With the acquisition of a war surplus stereoscope as a starting point, plans are being drawn for the construction of a blink microscope from already available material to be used for location or rediscvery of comets and asteroids. This instrument operates on the principle of persistence of vision, which enables a moving object to be detected on a pair of photographic plates, even though there may be thousands of star images registered on them.

**Meridian Circle**

Students of practical astronomy are the primary users of the four-inch meridian circle, housed in the east section of the first floor of the main Observatory building. In conjunction with the meridian circle the Observatory has a drum chronograph for obtaining precise times of the meridian passage of stars. Another chronograph is used with the twenty-inch refractor for the occultation program of the Observatory.

While it is no longer necessary to use the meridian circle for its original purpose of telling time by the stars, it is an excellent instrument available at any time for a world-wide program on latitude variation or for the re-determination of accurate star positions.

**Astronomical Clocks**

Chamberlin Observatory is the possession of two precision clocks, indispensable to astronomers. The mean time clock keeps very accurately the time of the time zone in which Denver is located. By use of an excellent Hallicraftor radio, time signals are received from the Naval Observatory in Washington, D.C., and corrections are recorded to the tenth of a second.

The second time-keeping device is the sidereal clock which keeps the time of the stars. Time checks are made on the accuracy of this clock by means of a comparison with the mean time clock and a mathematical conversion.

**Research**

**Present**

The staff of the Observatory is engaged in varied programs of astronomical research at the present time.

A program of research on occultations of stars by the moon is being carried out by Mr. Bardelet, Mr. Hewston and Mr. Francis Bonome, former graduate assistant. This program is of world-wide scope, and the statistical results are forwarded to Greenwich Observatory in England for compilation.
Instruction

Courses in astronomy are offered by the University of Denver using the equipment of Chamberlin Observatory for laboratory work. Astronomy courses may be combined with celestial mechanics in the department of mathematics to form a minor field with a mathematics or physics major. Mathematical courses in astronomy may be applied toward a mathematics major.

Four courses are offered treating astronomy from the descriptive point of view which is in accordance with the policy of the department and the Observatory to make astronomy available to students not seeking the more technical aspects. No mathematical prerequisite is required for three of these courses. The most advanced course requires a working knowledge of trigonometry.

A course is offered in celestial navigation which includes elements of descriptive astronomy as well as a complete short course in air navigation.

Practical astronomy enables the student to apply theories covered in earlier courses and to use the astronomical instruments of the Observatory.

Other advanced courses in astronomy are in the fields of astrophysics and orbit computation. The first is a study of the physics of the celestial bodies and the second an application of the theories of celestial mechanics which allows the student to go through the computation of the orbit of a planet, an asteroid, or a comet.

In addition to the formal courses offered, a student may investigate a particular phase of astronomy in which he is interested by registering for independent study under the guidance of a professor.

For further information see the Bulletin of the College of Arts and Sciences, obtainable upon request from the Director of Admissions of the University of Denver, Denver 10, Colo.

The director, Dr. Albert W. Recht, is continuing his computations of the motion of Comet d'Arrest with the assistance of Mr. Howerton.

Mrs. Ruth F. Kilby is a graduate student probing some of the problems of variable stars.

Future

As soon as the photometric photometer is completed, Mr. Bartlett and Mr. Howerton will begin the program of research on eclipsing double-star systems.

When the Schmidt-type camera is installed, it will be possible for the staff to engage in a world-wide campaign for the rediscovery of certain planets—those small "pieces of celestial real estate" which were lost through neglect during the war. It is for this purpose that the blink microscope is being designed.
Visitors' Night

Chamberlin Observatory is proud of the popular public service features of the program. Every Wednesday night throughout the school year and every Tuesday and Thursday night during the summer months, open house is held for anyone who wants to visit the Observatory and look through the twenty-inch refactor. Visiting hours are from 8 p.m. to 10 p.m. during May, June, July, and August, and from 7:30 p.m. to 9:30 p.m. during the remainder of the year. A feature of visitors' night is a lecture, usually by the director, on some phase of astronomy. There is no charge for visitors, but the director requests that any interested persons call the University of Denver Recreation Office, PEarl 3711, Extension 70, for a reservation. Since facilities are limited, a group of more than thirty persons does not allow each person sufficient use of the telescope. It is seldom that reservations need be made more than a week or two in advance.

In addition to regular public nights, the Observatory designates special nights for accommodating groups such as Boy or Girl Scout Troops, school classes, church groups, or any other interested group. No charge is made either for the use of the building or for the services of the personnel of the Observatory. Reservations for such appointments may be made by calling the director of the Observatory at PEarl 5797 or SPrice 4965.

During the course of the year about fifty celestial objects are shown to the public. Generally the same five or six of these are shown to the groups assembled during a given month. These objects fall chiefly within the following categories of celestial phenomena: the moon, a planet (when available), a star cluster, a nebula, a red star, a double star, and a bright star. A running commentary is given by the demonstrator during the showing to explain to visitors the significance of what they see.

Over a period of eighteen years, 37,857 visitors have come to the Observatory, and there have been 41,749 additional persons to whom the director has given talks on astronomy. During the last school year there were 3,345 visitors and 2,087 persons were lectured to in off-campus audiences.

For the convenience of visitors, the following are the topics which will be discussed in visitors' night lectures at the Observatory for the year 1948:

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Comet Pansarsopeudis
Staff

Albert W. Recht, Ph.D. .................. Director, Chamberlin Observatory

Thomas J. Bartlett, M.A. ................ Assistant Professor of Mathematics and Astronomy

Robert J. Howerton, M.S. ............. Graduate Research Assistant

Ruth F. Kiley, A.B. ......................... Graduate Assistant

George White, B.S. ...................... Engineer in charge of telescopes (formerly of Mt. Wilson and Mt. Palomar)

Star Field, Constellation of Auriga

The photograph below illustrates to some degree the magnificent performance of the eight-inch Schmidt-cassegrin camera presented to us recently by Mr. Clendenon S. Walton. With this instrument photographs can be obtained in fifteen minutes which show celestial objects that cannot be seen at all with the great twenty-inch refractor. It becomes apparent why this camera will be very useful in maintaining a patrol of the sky, on the lookout for new and interesting celestial objects. While its scale is small, it may become of great service also in the determination of positions of comets and asteroids. The need for observational material on the small planets is especially urged at this time.