OBSERVATORY STAFF
Albert W. Recht, Director. Address: 2221 South St., Paul Street, Denver, Colorado. Phone: PEAR 8707.
Ralph E. Meeker, Jr., Walter S. Peterson, Jr., Charles Sibley, Student Assistants.
Samuel J. Canfield, Eugene Willingham, Hyman Zuckerman, N.Y. Assistant.
Cloyd Arford, Student Custodian of Observatory Building.
Fred Meedenburg, Doorkeeper on Public Nights.
Arthur W. Beck, Volunteer Assistant, Occultation Program.
Caroline Petrie Beck, Volunteer Assistant, Occultation Program.
Glenda S. Walton, Volunteer Assistant, Variable Star Program.

COURSES IN ASTRONOMY
The director of the observatory carries a full teaching load in the University of Denver. Day classes in astronomy are offered as follows:

College of Liberal Arts: School of Science and Engineering
1. ELEMENTS OF DESCRIPTIVE ASTRONOMY
   A non-mathematical course with no prerequisites. Constellations of the sky and winter sky. Daily 5:00 and 11:40, Autumn quarter.

102. ADVANCED DESCRIPTIVE ASTRONOMY

108. PRACTICAL ASTRONOMY
   The general knowledge acquired in the previous courses is put to practical use in learning how to manipulate the instruments of astronomy: the large telescope, the transit, the sextant, etc. Daily at 11:40. Spring quarter.
   Night classes are scheduled to meet in the observatory on Monday evenings from 8:45 to 10:45. The offering follows:

University College
1a. A STUDY OF THE SKY
   Appreciation course in non-mathematical astronomy. Autumn.
1b. A STUDY OF THE SKY
   Continuation of 1a, but may be taken independently. Winter.
108a. SHORT COURSE IN PRACTICAL ASTRONOMY
   Use of the astronomical instruments, reduction of observations, celestial photography. Spring quarter.
   Courses 1a and 1b may also be taken by correspondence through the Extension Division of the University of Denver.

Cost $10 each course for credit; $5 only for auditors.
Chamberlin Observatory—Location and Activities

Chamberlin Observatory is situated in Denver, Colorado, at the extreme southwestern part of the city. It is in the 2900 block on East Warren Avenue—four blocks east of the University of Denver campus. The observatory is surrounded by a small park, which makes available a completely unobstructed view of the sky, although city lights interfere somewhat in the northeast.

The observatory has been the scene of much research work in the past, notably with nebulae, comets, and asteroids. Present research is limited to three fields: (1) a systematic watch of novel and irregular variable stars to observe sudden changes in their brightness, in charge of Mr. Claude C. Walton, Denver amateur astronomer; (2) observation and reduction of positions of faint stars by the moon, in charge of Mr. Arthur W. Beek and Mrs. Caroline Petrie Beek, who publish monthly lists of these observations; and (3) calculation of a definite orbit for the periodic Comet d'Arrest in order to bring together observations over a period of nineteen years, this project in charge of the director and conducted with the aid of an electric calculator, recently acquired.

A major activity of the observatory and its director for many years has been the entertainment and instruction of visitors. For example, the observatory entertained during the last school year 1,495 visitors, of whom 163 came on Thursday evenings, the regular public night. In addition, the director spoke on astronomical subjects to audiences comprising 1,432 persons.

This bulletin is compiled annually to give visitors information concerning the observatory and the celestial objects that may be seen through its great telescope.

Visitors' Evenings

Chamberlin Observatory is open to the public on clear Tuesday evenings throughout the school year between the hours of 7:30 and 9:30. So that attendance may be limited to persons that are really interested in astronomy, and in order to avoid unduly long lines, an admission fee of twenty-five cents is charged. The observatory may be visited on other evenings by classes or other groups interested in astronomy, and although no charge is made for this service, a demonstration fee must be paid in advance to avoid conflicting with observatory routine.

Visitors look through the 26-inch telescope one at a time. Because of this, the number of objects shown on a given night depends upon the number of people and the time taken by each one. Generally six or seven objects make up the evening's program, and a brief description of each object is given by the director. During the evening a short lecture, illustrated with slides, is given in a downstairs room. The titles of these talks are changed each month; they are listed under Monthly Programs. Whenever convenient, visitors are permitted to inspect the other astronomical equipment.

Perhaps it would be well to explain that first-time visitors to a large observatory usually anticipate seeing more than is possible to observe. They are therefore disappointed until they learn to appreciate the power of the telescope, and how many things are deduced to them that would have remained forever invisible without the instrument's aid.

Anyone visiting the observatory in cold weather should come prepared with sufficient wraps, because the temperature of the dome is always the same as outside. If the room were heated, the warm air would escape through the opening in the dome and the warm air currents passing out near the observer might distort light rays entering the telescope. A similar phenomenon may be observed in the heat rays rising above a hot radiator or stove.

For those interested in seeing a great variety of objects the winter season is best, because the visiting groups are smaller.
HISTORY AND PUBLICATIONS

The ground for the observatory building was broken in 1888. The building and equipment were the gift of Montgomery Balfour Chamberlin, who had many dreams of what might be accomplished by a large telescope at this high altitude, but who died in 1887, before he had an opportunity to see them fully realized. The cornerstone of the observatory was laid in 1889 and the building was completed in 1891. The telescope was not installed, however, until the summer of 1894.

Chamberlin Observatory was designed by Herbert Alonzo Howe, who was its director until his death in 1929, and it was built under his personal supervision. Dr. Howe was then Dean of the University of Denver. It was through his efforts that the gift was obtained, and it was through his great patience and industry that Chamberlin Observatory became one of the well-known observatories of the world.

In the 1897 bulletin there was published a complete list of the publications that have issued from Chamberlin Observatory since its founding. In this and successive bulletins it is planned to list only the publications of the preceding year. For 1937 these were as follows:


EQUIPMENT

Telescopes

20 INCH REFRACTOR—This telescope is the main instrument of the observatory and is housed in the large building. Its 20-inch lens was made by Alvan Clark and the mounting by Stoughton. It weighs over twelve tons and was built at a cost of $25,000, of which the lens cost $10,000. The telescope is generally used with a 17-power eyepiece for visitors. Its focal length is 26 feet 8 inches and the crown lens is irreducible for photography.

At the time of its construction the Chamberlin telescope ranked fifth in size in this country. It is still the twelfth largest refractor in the United States. The largest refractor in the world, the one at Washington, D.C., was made by the Yale University Observatory. It is 60 inches in diameter.

18 INCH REFRACTOR—This smaller telescope is housed in the students' observatory, located two hundred feet southwest of the main building. Its lens is by Grubb and the mounting by Grubb. It is used mainly by students and for observations of the sun, whose disk is observed directly with a polarizing eyepiece.

Meridian Circle

This instrument is in the east part of the main building. Its tube is four inches in diameter and it is used by students in the practical astronomy classes for determining the time from the stars.

Astronomical Clocks

SOLAR CLOCK—This instrument keeps standard time, being used by the astronomer for the location of celestial objects.

MEAN SOLAR CLOCK—This clock keeps mean solar time. Its error is obtained regularly by radio signals sent from the Naval Observatory at Washington, D.C. Both of these clocks have been kept in excellent condition, powered by a weight which is wound up once a week. While these clocks are not of the highest precision, their daily error is only a few seconds of a second.

Chronographs

There are two drum chronographs which are used in connection with the clocks for electrically and graphically recording the exact times when observations are made. Other equipment includes chronometers, a sextant, an electric calculator, and a short-wave radio receiver. There is also a fairly complete library. The cost of the observatory and its equipment was $66,000.

CELESTIAL OBJECTS SHOWN TO VISITORS

During the entire year about fifty different celestial objects are shown to the public. Generally six or seven of these make up the program each Tuesday evening for a given month. The routine is fixed under Monthly Program, and will be adhered to wherever possible. The same objects are shown throughout the year with the exception that the moon is not always in the sky during visiting hours; and at other times the moon may be too bright to permit the showing of faint objects.

The attempt has been made to select the most favorable and spectacular objects of each month. The result is that the same objects sometimes appear on more than one monthly program. The seven classes of objects explained below.

The Moon

Most of the planets have moons, or to call them by their true names, satellites, revolving about them. The earth has one satellite, and it is closer to us than any other celestial body; it has a diameter one-fourth that of the earth, but is a dead world, having neither air nor water. Open glass helps to reveal the moon's surface, but only a large telescope can show the details of its craters, mountains, and plains. The moon is seen to best advantage at the time of its first quarter or "half moon" phase. This is because the sunlight, instead of striking straight down upon the lunar mountaintops as it does when full moon, is then striking diagonally across them, casting dark shadows which make the surface features of the moon stand out in bold relief.

Plants

There are nine bodies revolving about the sun which are called planets, one of them our earth. They have no light of their own but are visible only because the sun is shining upon them. The brighter planets are shown through the telescope when they are in favorable positions during visiting hours. Mercury and Venus, the two planets closer to the sun than our earth, are seldom seen at these hours; Mercury practically never, and Venus only when it is on the occulted evening star, at its greatest apparent distance from the sun at intervals of twenty months. It is visible in the early evening.
during May-October, 1888. The planets further from the sun than our world are best seen when they are on the same side of the sun as the earth. In 1888 Mars was at the opposite side. Jupiter and Saturn are the largest and most interesting planets to observe. Uranus, Neptune, and Pluto are too far away to be seen in detail.

**Red Stars**
These are plant stars and are as red as stars ever became. They are generally variable in brightness.

**Bright Stars**
All of the stars are seen. Also the sun is a star, and only an average star at that. It is so much closer to the earth than any of the other stars that people seldom realize it is the same kind of body as the thousands of lights that dot our night sky. Our sun is over a million times larger than the galaxy. Stars appear very large in a telescope because they are too far away to reveal their disks, although the Chambertin telescope makes them appear about ten thousand times brighter.

**Double Stars**
Many stars that appear single to the unaided eye are revealed as double or multiple in a telescope. Some of these double stars are actually near one another while others are very close together because they happen to be in the same direction from the earth. The separation of double stars is given in seconds of arc. An arc sec 1" (one second) is equal to 1.360" with the angular width of the moon, or the apparent width of a dime observed at a distance of three miles. Only the bright and wider doubles are shown to visitors.

**Star Clusters**
These are aggregations of stars and are of two main types, the loose and the globular clusters. In loose clusters the stars are visible to the unaided eye, while in the globular type the stars are so concentrated in the center of the cluster that they are indistinguishable. Some of the latter type contain thousands of stars and are hundreds of light years in diameter.

**Nebulae**
Objects of this class are sometimes disappointing because they are so far away. A few can be seen by amateurs with telescopes equipped with special attachments. Some of the more interesting are the Great Nebula in Orion, the lake on the Milky Way, and the Great Nebula in Orion. All the gas and stars seen in the telescope appear as a single star to the naked eye. 400 light-years distant.

**MONTHLY PROGRAMS**
A part of each public night's program is a lecture upon some phase of astronomy. The lecture is repeated during the year. The date for the year's lecture is determined by the phase of the moon, and without exception they are illustrated with slides. The title of each lecture is listed at the beginning of the month in which it is given.

**JANUARY**
**LECTURE:** "Keeping Time with the Earth."**
**MOON:** First quarter on January 9.

**URANUS:** Ninth planet from the sun. 12,500 miles in diameter. About two billion miles distant. Has two moons, only two bodies visible with the telescope. Shows small greenish disk.

**SIRIUS (Alpha Canis Majoris):** Brightest of all stars. White in color. Called the "Dog Star." Nine light-years distant. Diameter twice our sun's.

**ETA CASIOPEIAE:** Double star. Separation, 4". Magnitudes 4 and 5. Resolve about each other in 180 years. 9 light-years distant.

**BETA ANDROMEDAE:** Red star. Magnitude of 8.

**OPEN CLUSTER IN ANDROMEDA:** Hundreds of stars filling the entire field of view. 1,400 light-years away.

**GREAT NEBULA IN ORION:** Great nebula. 400 light-years distant. About four light-years in diameter.

**FEBRUARY**
**LECTURE:** "Observatories and Telescopes."**
**MOON:** First quarter on February 1.

**URANUS:** Planet just beyond Saturn. Diameter four times that of earth, 12 times earth's distance from sun. Period, 44 years. Easily visible to eye. Shows small greenish disk in telescope.

**BETELGEUSE (Alpha Orionis):** First star to have its diameter measured. Diameter, 225 million miles. 27 million miles later than our sun and 1,000 times as bright. Orange in color. 250 light-years away.

**RIDEL (Beta Orionis):** White double star. Separation, 4". Magnitudes 9 and 7. 12,000 times brighter than the sun. 450 light-years away. Pair connected by a faint cloud in the telescope.

**BETA ANDROMEDAE:** Red giant of eighth magnitude.

**NO STEARS IN ORION:** Distance, 1,600 light-years. Cluster geostropic in shape.

**GREAT NEBULA IN ORION:** All the gas and stars seen in the telescope appear as a single star to the naked eye. 360 light-years distant.

**MARCH**
**LECTURE:** "The Earth's Moon."**
**MOON:** In first quarter on March 9.

**NEPTUNE:** Can be seen without the telescope. Eighth planet from the sun, 24,808 miles in diameter. Nearly 3 billion miles away. Shows small greenish disk.

**SIRIUS (Alpha Canis Majoris):** Brightest of all stars. Magnitude, 1.45. Distance, 25 light-years. Commonly known as the "Dog Star."

**CASTOR (Alpha Gemini):** One of the Gemini, "the Twins." Blue double star. Apparent separation, 6". Actual separation, seven billion miles. 43 light-years distant. Period of revolution, 327 years.

**CRATERES:** Variable red star. Its magnitude is 3.

**DOUBLE CLUSTER IN PERSEUS:** Loose cluster. 8,000 light-years away. Odd grouping.

**ELLiptical NEBULA IN Ursa MAJOR:** Fine spiral. First nebula in which focal length sections were detected.
APRIL

LECTURE. "Our Neighbors at the Solar System."

MOON. First quarter occurs on April 7.

NEPTUNE. Next to outermost planet from sun. Diameter four times that of earth. Distance, three billion miles. Shows a small greenish disk in telescope.

PROCYON (Alpha Gano Minoris). The "Little Dog Star." White star; magnitude 0.9. 10.6 light-years distant. Has diameter about 1 1/2 times that of sun.

AL GORGA (Gamma Leonis). Beautiful golden-yellow double. Separation, 4". Magnitudes, 3 and 4. Period of about 146 years.

R CHATENUES. Red star of magnitude 1. Visible without telescope.

GLOBULAR CLUSTER IN CANES VENATICI. Composed of thousands of stars. Distance, 45,700 light-years. About 472 light-years in diameter.

SPIRAL NEBULA IN CANIS VENATICI. Made up of stars too far away to be separated. Receding into space at a speed of 170 miles a second.

MAY

LECTURE. "The Nearest Star, Our Sun."

MOON. First quarter occurs on May 6.


SPICA Alpha Virginis). Blue star. Distance, 139 light-years. Magnitude, 1.2. A spectroscopic double, with a four-year period.

GAMMA VIRGINIS. Double star. Separation of 6". Both stars of fourth magnitude. Period of revolution, 184 years.

R CHATENUES. Variable red star of magnitude 5. Has color of spark.

GLOBULAR CLUSTER IN CANES VENATICI. Compact group of thousands of stars at distance of 40,000 light-years. Blown all planets; our sun could not be seen with largest telescope at this distance.

PLANETARY NEBULA IN HYDRA. Called so because of an apparent disk. Illuminated by a bright central star at an unusual rate.

JUNE

LECTURE. "The Tale of the Comet."

MOON. First quarter occurs on June 4.

VENUS. Shows brilliant disk in telescope, but no surface markings, because of clouds. About 120 million miles distant.

ARCTURUS (Alpha Bootis). Bright orange star. 23 light-years distant. Diameter about 50 million miles. Its light used to turn on illumination of Chicago's Century of Progress Exposition.

AL OPHIUCHI. Long-period double star. Both of the 5th magnitude. Separation, 42".

T LYRAE. Red star of the seventh magnitude.

GLOBULAR CLUSTER IN SERPENS. 35,000 light-years distant. One of the nearest clusters.

SPIRAL NEBULA IN CANIS VENATICI. An exterior Milky Way system. Shown best on darkest nights. Long-exposure photographs required to show its invisible details.

JULY

LECTURE. "Our Neighbors at the Solar System."

MOON. First quarter occurs on July 4.

VENUS. Second planet from sun, and nearly same size as earth. Easily shown gibbous phase. By end of month is just as far away as sun.

Vega (Alpha Lyrae). Second brightest star visible from northern latitudes. Blue-white color. 26 light-years distant. Diameter about 2 1/2 times that of sun; fifty times brighter. In 12,000 years will be the pole star.


T LYRAE. Burst orange colored star of magnitude 7. Giant star, temperature 2,500°.

GLOBULAR CLUSTER IN HERCULES. Faint globular cluster. 50,000 stars have been counted in photographs. 12,000 light-years away. 320 light-years across.

PLANETARY NEBULA IN DRACO. About 60 light-years away. Illuminated by a central star of each high temperature that energy is released in ultraviolet.

AUGUST

LECTURE. "The Nearest Star, Our Sun."

MOON. First quarter occurs on August 3.

VENUS. Brightest object in the evening sky except the moon. About 50 million miles away this month. Greatest brilliancy in 1939 occurs on October 13 and again on December 24 as a morning star. On September 16 will be farthest east from the sun, and will have first-quarter phase.

ARCTURUS (Alpha Bootis). Bright orange star. 45 light-years away. Diameter about 32 million miles. Its light was used to turn on illumination of Chicago's Century of Progress Exposition.

EPSILON LYRAE. A double-double star. 350 light-years distant. The doubles are separated by 1377. The separations of the individual pairs are 3" and 5".

T LYRAE. Red star of magnitude 7.

100 STARS IN SAGITTARIUS. A fine course cluster. About 3,000 light-years away.

THEME NEBULA IN SAGITTARIUS. A diffuse circular cloud which is partly obscured by lanes of dark matter.

SEPTEMBER

LECTURE. "The Tale of the Comet."

MOON. First quarter occurs on September 1.

JUPITER. The largest planet. 36,900 miles in diameter; 11 times that of earth. Puts phase out from the sun. Has nine moons; four visible in telescope. About 109 million miles away.

Vega (Alpha Lyrae). Bright blue star, second brightest visible from northern latitudes. Fifty times as bright as our sun. At distance of 26 light-years.

Zedar (Zeta Ursae Majoris). White double; separation 15". Magnitudes, 3 and 4. Each star is a close double, detected only by spectroscopic methods, 12 light-years.

RZ EQUINOX. Red star. Eclipses magnitude.

GLOBULAR CLUSTER IN HERCULES. Bright cluster visible from northern latitudes. Contains many thousands of stars. 24,000 light-years distant.

RING NEBULA IN LYRA. Planetary type illuminated by a central star, at limit of visibility for the Chamberlin 20-inch. Over 356 light-years away. One of few nebulae to be seen in full moonlight.

1938
OCTOBER

LEISURE—"The Universe of Stars"

MOON: First quarter on October 1 and 31.

JUPITER: Largest of the planets. Especially interesting because of the churning position of its four bright moons, and its cloud bands.

SATURN: The famous ringed planet. Sixth planet from the sun, 9,500 miles in diameter. About 9,740 miles from us. Has two moons of which only four or five may be seen. Rings are not a large part but a large position.

Venus (Alpha Lyre). Second only to "Dog Star" in brilliance, for stars visible from our latitude. Blue-white star five times as bright as our sun. In 28 light-years distant.

POLARIS (Alpha Ursae Minoris). The North or Navigator's Star. Has faint green companion, 15° away. Distance, 476 light-years.


GLOBULAR CLUSTER IN MONOCEROS. Planet cluster to be seen from this latitude. Telescope shows about one thousand stars. Distance, 4,000 light-years.

RING NEBULA IN LYRA. Planetary type illuminated by a central star. About 10,000 light-years distant. Shows easily in full moonlight.

NOVEMBER

LEUCHE—"Shooting Stars—the Meteors."

MOON: First quarter on November 28.

SATURN: Second largest planet, and the only one surrounded by a ring. Distance, about 9,500 miles from the earth. Four or five of its moons generally seen. Rings last barely past midnight.

ALFA (Alpha Aquilae). White star of almost exactly the first magnitude. 15 light-years away.


BOLAND CYGNUS. Giant star of yellow type. Has color of burning ember.

GLOBULAR CLUSTER IN PEGASUS. More confused group than the Hercules cluster. Stars range from small in size. About 43,500 light-years away.

PLANETARY NEBULA IN AQUARIUS. Sometimes called the "Saturn Nebula." Was once thought to be a star.

DECEMBER

LEUCHE—"The Beginning Universe."

MOON: At first quarter on December 29.

THANKS. The seventh planet from the sun, 12,400 miles in diameter. Almost 2,000 miles miles distant. Has four moons, only two visible with the Crab's seat. telescope. Shows same greenish tint.

SATURN. The famous ringed planet. Sixth planet from the sun, 11,000 miles in diameter. About 9,600 miles from us. Has nine moons of which four or five may be seen. Rings are large part of the planet.

CAPRA (Alpha Aurigae). A yellow star like our sun. 44 light-years distant. Really 400 times as far, very fast. Too small to divide with any telescope.

GAMMA ANDROMEDAE. Triple star of magnitudes 2.5 and 7. The separation of the brighter star is 13°, much like the fainter part, 1°.

4 ANDROMEDAE. Red star of magnitude 8.

STAR CLOUD IN CANCER. A faint star in the Milky Way. 6,000 light-years away.

GREAT NEBULA IN ORION. Greatly illuminated by involved stars. 600 light-years distant. About four light-years across.

RECENT ASTRONOMICAL LITERATURE

(The last opinion gives the name and page number of Popular Astronomy or Scientific American in which a critical review of the book may be found.)

BOOKS ON MYSTIC SCIENCE—"The Universe of Stars—"The Moon's Age."

Popular Books

Popular Books—"The Universe of Stars—"The Moon's Age."

Baker, E. C. [Editor]. [Title]. New York: [Publisher], [Publication Date].

Popular Astronomy—"The Moon's Age."

Baker, E. C. [Editor]. [Title]. New York: [Publisher], [Publication Date].

Popular Science—"The Universe of Stars."

Baker, E. C. [Editor]. [Title]. New York: [Publisher], [Publication Date].

Scientific American—"The Universe of Stars."

Baker, E. C. [Editor]. [Title]. New York: [Publisher], [Publication Date].