OBSERVATORY STAFF

Albert W. Recht, Director. Address: 2251 South St. Paul Street, Denver, Colorado. Phone: PEarl 8797.

Ralph L. Meeker, Jr., Walter S. Peterson, Jr., Charles Sibley, Student Assistants.

Samuel J. Camerlo, Eugene Willingham, Hyman Zuckerman, NYA Assistants.

Cloyd Arford, Student Custodian of Observatory Building.

Fred Muetzenberg, Doorkeeper on Public Nights.

Arthur W. Beck, Volunteer Research Associate, Occultation Program.

Caroline Petrie Beck, Volunteer Research Associate, Occultation Program.

Clendon S. Walton, Volunteer Research Associate, 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 fall and winter sky. Daily, 8:00 and 11:40. Autumn quarter.

102. ADVANCED DESCRIPTIVE ASTRONOMY

Plane trigonometry is prerequisite. A mathematical application of Course 1. Daily at 11:40. Winter quarter.

103. 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 6:45 to 8:45. 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.

103a. SHORT COURSE IN PRACTICAL ASTRONOMY

Use of the astronomical instruments, reduction of observations, celestial photography. Spring quarter.

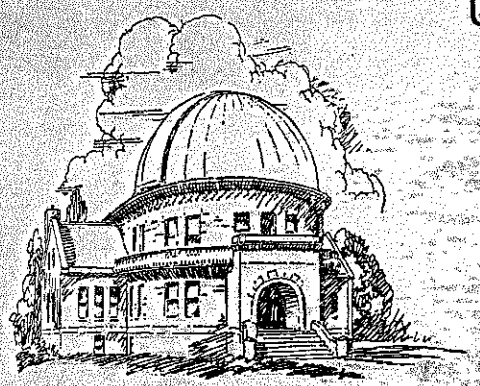
Courses 1a and 1b may also be taken by correspondence through the Extension Division of the University of Denver.

*Cost $10 each course for credit; $5 only for auditors.

1938 BULLETIN

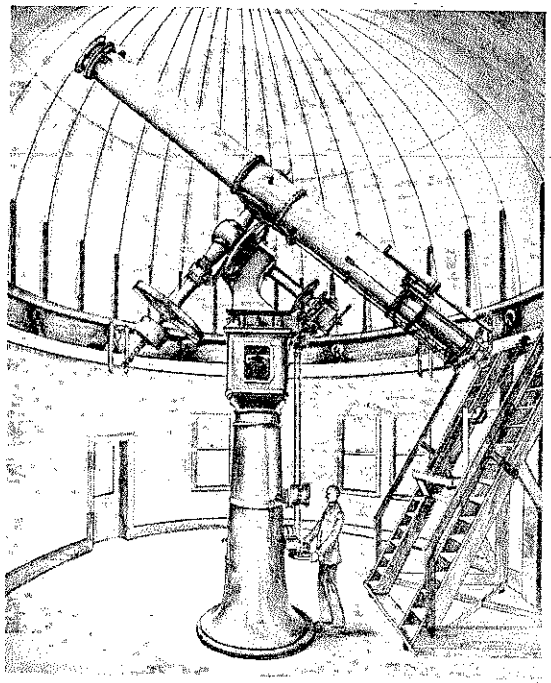
of the

CHAMBERLIN OBSERVATORY



UNIVERSITY *of* DENVER

Denver, Colorado



THE CHAMBERLIN 20-INCH REFRACTOR

Pencil Sketch by Wm. N. Turnbull, Jr.

CHAMBERLIN OBSERVATORY—LOCATION AND ACTIVITIES

Chamberlin Observatory is situated in Denver, Colorado, in the extreme southeastern 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 northwest.

The observatory has been the scene of much research work in the past, mainly with nebulae, comets, and asteroids. At present research is limited to three fields: (1) a systematic watch of novae and irregular variable stars to observe sudden changes in their brightness, in charge of Mr. Clendon S. Walton, Denver amateur astronomer; (2) observation and reduction of eclipses of faint stars by the moon, in charge of Mr. Arthur W. Beck and Mrs. Caroline Petrie Beck, who publish six-month lists of these observations; and (3) calculation of a definitive orbit for the periodic Comet d'Arrest in order to bring together observations over a period of seventy-two 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 1,437 visitors, of whom 165 came on Tuesday evenings, the regular public night. In addition, the director spoke on astronomical subjects to audiences comprising 1,453 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 unwieldly groups, 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 or for talks given by the director, all engagements must be made far in advance to avoid conflicting with observatory routine.

Visitors look through the 20-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 it is possible to observe. They are therefore disappointed until they learn to appreciate the power of the telescope, and how many things are disclosed 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 room is always the same as out-of-doors. If the room were heated, the warmth would only escape through the opening in the dome and the warm air currents passing out near the object lens would 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 Humphrey Barker Chamberlin, who had many dreams of what might be accomplished by a large telescope at this high altitude, but who died in 1897, before he had an opportunity to see them fully realized. The corner-stone of the observatory was laid in 1890 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 1926, 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 1937 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:

A. W. Beck and Caroline Petrie Beck. 94 Occultations by the Moon. Astronomical Journal; vol. 46, p. 101.

Annual Report from Chamberlin Observatory. Publications of American Astronomical Society; vol. 9, p. 64.

EQUIPMENT

Telescopes

20-INCH REFRACTOR—This telescope is the main instrument of the observatory and is housed in the larger building. Its 20-inch lens was made by Alvan Clark and the mounting by Saegmuller. It weighs over twelve tons and was built at a cost of $21,000, of which the lenses cost $11,000. The telescope is generally used with a 175-power eye-piece for visitors. Its focal length is 26 feet 8 inches and the crown lens is reversible 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 nearest refractors to Denver that are larger are the Yerkes 40-inch telescope at Williams Bay, Wisconsin, the largest in the world, and the 24-inch Lowell telescope at Flagstaff, Arizona.

6-INCH REFRACTOR—This smaller telescope is housed in the Students' observatory, located two hundred feet southwest of the main building. Its lens is by Brashear 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 eye-piece.

Meridian Circle

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

Astronomical Clocks

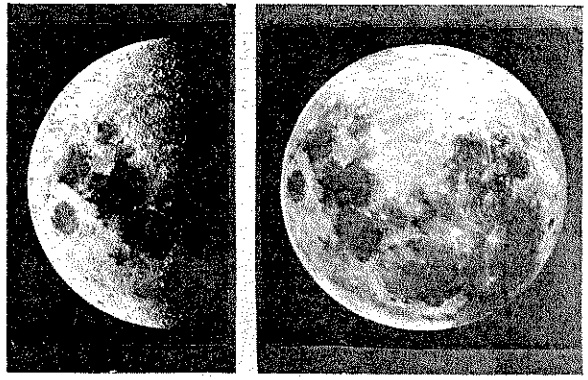
SIDEREAL CLOCK—This instrument keeps star-time, valuable to the astronomer for the location of celestial objects.

MEAN SOLAR CLOCK—This clock keeps standard time. Its error is obtained regularly by radio signals sent from the Naval Observatory at Washington, D. C. Both of these clocks have compensated second pendulums, powered by a weight which is wound up once a week. While these clocks are not of the highest precision, their daily change is only a few tenths 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 $56,000.



Quarter Moon, October 19, 1931. Full Moon, October 26, 1931. Photographs Taken with Chamberlin Telescope.

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 listed under Monthly Programs and will be adhered to whenever possible. The same objects are shown throughout a given month with the exceptions 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 nebulae.

The attempt has been made to select the most favorable and spectacular objects for each month. The result is that the same objects sometimes appear on more than one monthly program. The seven classes to which the objects observed belong are 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. Opera glasses help to reveal the moon's features, but only a large telescope can show the fine 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 shining straight down upon the lunar mountains as it does at full moon, is then shining diagonally across them, causing black shadows which make the surface features of the moon stand out in bold relief.

Planets

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 the so-called evening star, at its greatest apparent distance from the sun at intervals of twenty months. It is visible in the early evening

1938

during May-October, 1938. The planets farther from the sun than our world are best seen when they are on the same side of the sun as the earth. In 1938 Mars will not be visible. 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 giant stars and are as red as stars ever become. They are generally variable in brightness.

Bright Stars

All of the stars are suns. Also our 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 that 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 earth. Stars never appear any larger in a telescope because they are too far away to reveal their disks, although the Chamberlin 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 only appear close together because they happen to be in almost the same direction from us. The separation of double stars is given in seconds of arc. An arc of 1" (one second) is equal to 1/1800th 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 separate stars are visible; 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 faint, although a few can be shown in full moonlight. Nebulae are of two types: those in our own Milky Way which are composed of dust and gas illuminated by surrounding stars, and those called spiral or elliptical nebulae which are entirely separate universes from ours. The latter type are composed of stars and are so large and far away that the human mind cannot comprehend the distances. A more accurate name for these is exterior galaxies, or Milky Way systems beyond our own.

MONTHLY PROGRAMS

A part of each public night's program is a lecture upon some phase of astronomy. The same lecture is repeated throughout a given month. The talks for the year form a brief resume of the field of descriptive astronomy, 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.

The distances to celestial objects are so great that they are usually given in light-years. A light-year is the distance that light travels in one year at the enormous speed of 186,284 miles a second, or about 5,800,000,000,000 miles.

The magnitude of a star means its classification according to brightness. Each unit of magnitude represents a difference in brightness of 2½ times. For instance, a first magnitude star is 2½ times brighter than a second magnitude star, and a second magnitude star is in turn 2½ times brighter than a third, and so on. A sixth magnitude star is barely visible to the unaided eye. The limit of the Chamberlin telescope is magnitude 15½; the limit for the 100-inch reflector at Mt. Wilson is magnitude 19.

JANUARY

LECTURE. "Keeping Time with the Earth."

MOON. First quarter on January 9.

URANUS. Seventh planet from the sun. 32,000 miles in diameter. Almost two billion miles distant. Has four moons, only two visible with the Chamberlin 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, 1,700,000 miles.

ETA CASSIOPEIA. Double star. Separation, 6". Magnitudes, 4 and 8. Revolve about each other in 508 years. 17 light-years distant.

B4 ANDROMEDAE. Red star. Magnitude of 8.

OPEN CLUSTER IN AURIGA. Hundreds of stars filling the entire field of view. 4,000 light-years away.

GREAT NEBULA IN ORION. Gaseous nebula. 600 light-years distant. About four light-years in diameter.

FEBRUARY

LECTURE. "Observatories and Telescopes."

MOON. First quarter on February 7.

URANUS. Planet just beyond Saturn. Diameter four times that of earth. 19 times earth's distance from sun. Period, 84 years. Barely 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 times larger than our sun and 1,600 times as bright. Orange in color. 250 light-years away.

RIGEL (Beta Orionis). White double star. Separation, 9". Magnitudes 0 and 7. 12,000 times brighter than the sun. 450 light-years away. Faint companion almost hidden in brilliance.

B4 ANDROMEDAE. Red giant of eighth magnitude.

30 STARS IN ORION. Distance, 1,500 light-years. Cluster geometric in shape.

GREAT NEBULA IN ORION. All the gas and stars seen in the telescope appear as a single star to the naked eye. 600 light-years distant.

MARCH

LECTURE. "The Earth's Moon."

MOON. Is at first quarter on March 9.

NEPTUNE. Cannot be seen without the telescope. Eighth planet from the sun, 31,000 miles in diameter. Nearly 3 billion miles away. Shows small green disk.

SIRIUS (Alpha Canis Majoris). Brightest of all stars. Magnitude, —1.58. Distance, nine light-years. Commonly known as the "Dog Star."

CASTOR (Alpha Geminorum). One of the Gemini, "The Twins." Blue double star. Apparent separation, 5"; actual separation, seven billion miles. 42 light-years distant. Period of revolution, 347 years.

R CRATERIS. Variable red star. Its magnitude is 8.

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

ELLIPTICAL NEBULA IN URSA MAJOR. Fine spiral. First nebula in which internal motions were detected.

1938

APRIL

LECTURE. "Our Neighbors of 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 Canis Minoris). The "Little Dog Star." White star; magnitude 0.5. 10 light-years distant. Has diameter about 1½ times that of sun.

AL GIEBA (Gamma Leonis). Beautiful golden-yellow double. Separation, 4″. Magnitudes, 2 and 4. Period of about 400 years.

R CRATERIS. Red star of magnitude 8. Invisible without telescope.

GLOBULAR CLUSTER IN CANES VENATICI. Composed of thousands of stars. Distance, 40,000 light-years. About 470 light-years in diameter.

SPIRAL NEBULA IN CANES 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. At first quarter on May 6.

VENUS. Most brilliant planet. Second from the sun. Sister planet of earth, having nearly same diameter. About 140 million miles away. Sets about 8:30 p.m.

SPICA (Alpha Virginis). Blue star. Distance, 190 light-years. Magnitude, 1.2. A spectroscopic double, with a four-day period.

GAMMA VIRGINIS. Double star. Separation of 6″. Both stars of fourth magnitude. Period of revolution, 180 years.

R CRATERIS. Variable red star of magnitude 8. Has color of spark.

GLOBULAR CLUSTER IN CANES VENATICI. Compact group of thousands of stars at distance of 40,000 light-years. Stars all giants; 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 of an unusual type.

JUNE

LECTURE. "The Tale of the Comets."

MOON. Is at first quarter 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. 40 light-years distant. Diameter about 22 million miles. Its light used to turn on illumination at Chicago's Century of Progress Exposition.

36 OPHIUCHI. Long period double star. Both of the fifth magnitude. Separation, 4″.

T LYRAE. Red star of the seventh magnitude.

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

SPIRAL NEBULA IN CANES VENATICI. An exterior Milky Way system. Shows but dimly on darkest nights. Long-exposure photographs required to show magnificent details.

JULY

MOON. First quarter phase occurs on July 4.

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

VEGA (Alpha Lyrae). Second brightest star visible from northern latitudes. Blue-white color. 26 light-years distant. Diameter about 2½ times that of sun; fifty times brighter. In 12,000 years will be the pole star.

POLARIS (Alpha Ursae Minoris). The Pole Star. Has a ninth magnitude companion. Separation, 18″. The North Star is 470 light-years away.

T LYRAE. Burnt orange colored star of magnitude 7. Giant star, temperature 2,800°.

GLOBULAR CLUSTER IN HERCULES. Finest globular cluster. 50,000 stars have been counted in photographs. 34,000 light-years away. 320 light-years across.

PLANETARY NEBULA IN DRACO. About 600 light-years away. Illuminated by a central star of such high temperature that energy is released in ultra-violet.

AUGUST

MOON. First quarter on August 3.

VENUS. Brightest object in the evening sky except the moon. About 80 million miles away this month. Greatest brilliancy in 1938 occurs on October 15 and again on December 26 as a morning star. On September 10 will be farthest east from the sun, and will show first-quarter phase.

ARCTURUS (Alpha Bootis). Bright orange star. 40 light-years away. Diameter about 22 million miles. Its light was used to turn on illumination of Chicago's Century of Progress Exposition.

EPSILON LYRAE. A double-double star. 250 light-years distant. The doubles are separated by 207″. The separations of the individual pairs are 2″ and 3″.

T LYRAE. Red star of magnitude 7.

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

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

SEPTEMBER

LECTURE. "Stars and Their Stories."

MOON. First quarter occurs on September 1.

JUPITER. The largest planet; 88,000 miles in diameter or 11 times that of earth. Fifth planet out from the sun. Has nine moons, four visible in telescope. About 400 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.

MIZAR (Zeta Ursae Majoris). Wide double; separation 14″. Magnitudes, 2 and 4. Each star is a close double, detected only by spectroscope. Distance, 72 light-years.

B521 CYGNI. Red star. Eighth magnitude.

GLOBULAR CLUSTER IN HERCULES. Best cluster visible from northern latitudes. Contains many thousands of stars. 34,000 light-years distant.

RING NEBULA IN LYRA. Planetary type illuminated by a central star, at limit of visibility for the Chamberlin 20-inch. Over 300 light-years away. One of few nebulae to be seen in full moonlight.

1938

OCTOBER

LECTURE. "The Universe of Stars."

MOON. First quarter on October 1 and 31.

JUPITER. Largest of the planets. Especially interesting because of the changing position of its four bright moons, and its cloud belts.

SATURN. The famous ringed planet. Sixth planet from the sun. 72,000 miles in diameter. About 750 million miles from us. Has nine moons of which only four or five may be seen. Rings are only a little past edgewise position.

VEGA (Alpha Lyrae). Second only to "Dog Star" in brightness, for stars visible from our latitude. Blue-white star fifty times as bright as our sun. Is 26 light-years distant.

POLARIS (Alpha Ursae Minoris). The North or Navigator's Star. Has faint green companion, 18" away. Distance, 470 light-years.

T LYRAE. Red star of magnitude 7. Not visible without telescope.

GLOBULAR CLUSTER IN HERCULES. Finest cluster to be seen from this latitude. Telescope shows about one thousand stars. Distance, 34,000 light-years.

RING NEBULA IN LYRA. Planetary type illuminated by a central star. About 300 light-years distant. Shows easily in full moonlight.

NOVEMBER

LECTURE. "Shooting Stars—the Meteors."

MOON. First quarter on November 29.

SATURN. Second largest planet, and the only one surrounded by a ring. Distance, about 750 million miles from the earth. Four or five of its nine moons generally seen. Rings just barely past edgewise position.

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

ALBIREO (Beta Cygni). An optical double. Faint star is a great distance beyond the brighter. Separation, 35". Magnitudes, 3 and 5.

B521 CYGNI. Giant star of reddest type. Has color of burning ember.

GLOBULAR CLUSTER IN PEGASUS. More condensed group than the Hercules cluster. Stars run together in center. About 43,000 light-years away.

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

DECEMBER

LECTURE. "The Expanding Universe."

MOON. At first quarter on December 29.

URANUS. The seventh planet from the sun. 32,000 miles in diameter. Almost 2 billion miles distant. Has four moons, only two visible with the Chamberlin telescope. Shows small greenish disk.

SATURN. The famous ringed planet. Sixth planet from the sun; 72,000 miles in diameter. About 750 million miles away. Has nine moons of which four or five may be seen. Ring near edgewise position.

CAPELLA (Alpha Aurigae). A yellow star like our sun. 46 light-years distant. Really made up of two suns, separated by .05", too close to divide with any telescope.

GAMMA ANDROMEDAE. Triple star of magnitudes 2, 5, and 7. The separation of the brighter stars is 10"; the fainter pair, 1".

B4 ANDROMEDAE. Red star of magnitude 8.

STAR CLOUD IN CASSIOPEIA. Faint stars in the Milky Way. 10,000 light-years away.

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

RECENT ASTRONOMICAL LITERATURE

(The last column gives the volume and page number of Popular Astronomy or ‡Scientific American where a critical review of the book may be found.)

POPULAR BOOKS

Baker, R. H.	†Introduction to Astronomy—Van Nostrand	'35	$3.00	43;470
Bartky, W.	†*Highlights of Astronomy—Univ. of Chicago	'35	$2.50	44;347
Carnegie Institution	Studies in Astronomy—(Wash., D. C.)	'35	50c	
Eddington, A. S.	†New Pathways in Science—Macmillan	'35	$3.00	152;227‡
Fath, E. A.	†Through the Telescope—McGraw-Hill	'36	$2.75	44;225
Fisher, Clyde	†Exploring the Heavens—Crowell	'37	$2.50	158;126‡
Grover, F. W.	The Pageant of the Heavens—Longmans	'37	$3.00	158;137‡
Harding, A. M.	*Astronomy—Garden City	'36	$1.98	44;406
Hay, W. T.	†Through My Telescope—Dutton	'36	$1.50	44;524
Jeans, J. H.	†*The Universe Around Us—Macmillan	'34	$4.00	
	†*Through Space and Time—Macmillan	'35	$3.00	43;396
Jones, H. S.	†*Worlds Without End—Macmillan	'35	$3.00	44;289
Lockwood & Draper	†The Earth Among the Stars—Basic Books, Inc.	'36	50c	154;111‡
Menzel, D. H.	†*Stars and Planets—University Society	'35	$1.00 and 65c	
Moulton, F. R.	Consider the Heavens—Doubleday	'35	$3.00	44; 59
Phillips & others	†*Splendour of the Heavens—Putnam	'31	$8.50	35;355
Proctor, Mary	Wonders of the Sky—Warne	'36	1s 6d	147;126‡
Reh, F.	†Astronomy for the Layman—Appleton-Century	'36	$3.00	155;182‡
Stetson, H. T.	†*Man and the Stars—Grosset	'36	$1.00	39; 80
Stokley, J.	†*Stars and Telescopes—Harper	'36	$2.00	44;346
Van den Bergh, G.	Astronomy for the Millions—Dutton	'37	$2.50	158;127‡
Wagner, Norton	*Unveiling the Universe—Research Publishers	'37	$1.00	45;578

JUVENILE

Collins, A. F.	†Boy Astronomer—Lothrop	'36	$2.00	
Frost, E. B.	†Let's Look at the Stars—Houghton	'35	$1.75	
Johnson, G.	Stars for Children—Macmillan	'34	$1.50	152;167‡
Lewis, Isabel	†*Astronomy for Young Folks—Duffield	'22	$2.00	41;124
Martin & Youmans	How to Make Sky Pictures—Greenberg	'36	$1.00	
Reed, W. M.	†*Stars for Sam—Harcourt	'31	$3.00	146; 63‡
Swezey & Gable	†Boys' Book of Astronomy—Dutton	'36	$2.00	
Washburne & others	†Story of Earth and Sky—Appleton-Century	'35	$1.32	149; 94‡

BOOKS FOR STAR STUDY

Baker, R. H.	†Introducing the Constellations—Viking	'37	$2.50	
Barton & Barton	†Guide to the Constellations—McGraw-Hill	'35	$3.00	43;607
Bernhard & others	†*Handbook of the Heavens—McGraw-Hill	'35	$1.00	44;176
Fels Planetarium	Constellations—(Philadelphia)	'36	35c	44;165
Johnson, G.	†Discover the Stars—Leisure League	'35	25c	
McKready, Kelvin	†A Beginner's Star Book—Putnam	'37	$3.50	158;127‡
Murphy, E. G.	†*Beginner's Guide to the Stars—Putnam	'24	$1.00	39;204
Norton, A. P.	*Star Atlas—Eastern Sci. Sup. Co.	'31	$4.75	42; 57
Olcott, W. T.	†Field Book of the Skies—Putnam	'36	$1.75	
Proctor, Mary	Our Stars Month by Month—Warne	'37	$1.00	

BOOKS ON SPECIAL SUBJECTS

Bok, Bart J.	*The Distribution of Stars in Space—Univ. of Chicago	'37	$2.50	45;520
Eddington, A. S.	†*Expanding Universe—Macmillan	'33	$2.00	148;303‡
Frost, E. B.	†Astronomer's Life—Houghton	'33	$3.50	
Gray, G. W.	†The Advancing Front of Science—McGraw-Hill	'37	$3.00	158; 62‡
Hubble, Edwin	†*Realm of the Nebulae—Yale	'36	$3.00	
Humphreys, W. J.	†Weather Proverbs and Paradoxes—Williams and Wilkins	'34	$2.00	44;228
Ingalls, A. G.	Amateur Telescope Making—Advanced—Scientific American	'37	$3.00	45;403
Ingalls, A. G.	†*Amateur Telescope Making—Scientific American	'33	$3.00	41;204
King, E. S.	*Celestial Photography—Eastern Sci. Sup. Co.	'30	$3.00	39;179
Stetson, H. T.	Sunspots and Their Effects—McGraw-Hill	'37	$3.00	46; 65
Wilson, P. W.	†The Romance of the Calendar—W. W. Norton	'37	$3.00	45;577
Mitchell, S. A.	†*Eclipses of the Sun—Columbia Univ.	'35	$5.00	41;236
Nininger, H. H.	†*Our Stone-Pelted Planet—Houghton	'33	$3.00	41;352
Russell, H. N.	The Solar System and Its Origin—Macmillan	'35	$2.00	44;286

PERIODICALS

*Monthly Evening Sky Map—Leon Barritt, New York City	$1.50
†*Popular Astronomy—Carleton College, Northfield, Minn.	4.00
*Sky—Hayden Planetarium, New York City	1.50
*The Telescope—Harvard Observatory, Cambridge, Mass.	1.00

†In Denver Public Library. *In University of Denver Library.

1938