The Monthly Publication of the

Milwaukee Astronomical Society

Milwaukee, Wisconsin

E. A. de la Ruelle, President.

Miss Elizabeth Wight, Vice-President. L. E. Armfield, Secretary-Treasurer.

Vol. 1, No. 1 FEBRUARY 1934 Ten Cents

INTRODUCTION

BY A. E. DE LA RUELLE.

ON A CLEAR NIGHT, with the moon absent, and the great dome of the sky filled with glittering stars of varied color and brilliancy, some with a vivid color, perpetually changing and twinkling; others more constant, beaming tranquilly and softly upon us — we are ready to witness one of the sublime spectacles of nature and enjoy its wierd and wondrous beauty. We come in communion with another life, and the soul asserts its immortality, crying with the prophet of old, "The Heavens declare the glory of God."

Many laymen are puzzled, irritated or tantalized about the science of astronomy, and would like to know what it is up to, unaware that in the last 50 years there has been the greatest revolution since Copernicus. From Pythagoras to Einstein the astronomers have traced the development of its mathematics and its philosophy through magic and materialism.

In the new dispensation "matter begins to thin away into the completely spectral things it has now become." The notion of substance had to be replaced by the notion of behaviorism. Determinism has broken down, and the principle of indeterminacy has taken its place. Science is no longer implacable and omnicient and no longer compels us to believe in our own essential futility, but loving nature in all its varied phases helps us to understand somewhat of the wisdom, power, beneficience and grandeur displayed in the Divine harmony of the Universe.

THE PUBLICATIONS COMMITTEE extends greetings to all of you, officers, members, and friends of the Milwaukee Astronomical Society.

The purpose of this magazine is to be three-fold:

1. To acquaint the members of the society with the activities and endeavors of each other in the astronomical field. To unite the various activities of the society into one unit, and to keep the members informed of the important occurrences and developments in the science.

2. To introduce the society and its activities to prospective members and to the general public. We hope by so doing to increase the membership and the scope of the society.

3. To acquaint the professional astronomers with the fact that there *is* a Milwaukee Astronomical Society and that one of its objects is to contribute research data to the professional members of the Science.

We, of the publications committee, feel that these are worthy purposes and will endeavor to fulfill the obligations imposed upon us to the full extent of our abilities. Mistakes may be made, both in thought and in the manner of presentation, but we hope with the fullest cooperation of each and every member, to present to you each month, a magazine which will be worthy of the society and of major interest to every member.

Committee on Publications.

Subscription price $1.00 per year of 12 issues. Contributions are solicited but cannot be paid for. Their publication, either in whole or in part, is solely at the discretion of the committee on publications. Address all comunications to the secretary of the society, Mr. L. E. Armfield, 2046 S. 59th St., Milwaukee, Wis.

THE JUNIOR AUXILIARY.

The Junior Auxiliary of the Milwaukee Astronomical Society is composed of boys and girls of high school age interested in the subject of astronomy. The meetings of the Junior Auxiliary are held in conjunction with the meetings of the Senior Society, the Junior meeting starting at 7:00 P. M.

Papers and extemporaneous talks on subjects relating to Astronomy are given at the meetings by the members. Papers to be given in the near future will cover such subjects as Venus, Saturn, Pluto, and the Sun. A paper on sidereal time and the principle used in obtaining correct time by the meridian transit of a star is to be presented at the next meeting. Difficult questions are answered by an advisory council consisting of five senior members elected by the junior members and subject to approval by the executive board of the Senior Society. The construction of telescopes and other instruments for astronomical observation is encouraged by informal discussion. Various problems relating to the grinding and polishing of mirrors, construction of mountings, and many other related subjects are open to discussion at the meetings of the Junior group. The juniors are encouraged to attend the meeting of the Senior Society which follows the junior meeting. —Joseph F. Loepfe, Pres.

COMMITTEE REPORTS.

Program: L. H. Mathias—Special attention is called to the lecture by Mr. Phillips on The Telescope's Part in the Advance of Astronomy, to be given at the Museum Lecture Hall, Wednesday evening, February 28 at 8:00 P. M. The next meeting of the society will be held at the University Extension Bldg., Mar. 2. Juniors at 7:00 P. M., "The Eclipse of Io by Ganymede, Dec. 2, 1931," by H. W. Cornell, at 8:00 P. M., and "Meteors," by L. E. Armfield, 9:00 P. M.

Publicity: H. W. Cornell—Activities consist of the usual attempt to have the daily papers of the city print a few lines about each meeting. The Museum lectures have offered another source of publicity that has been greatly used, thanks to the Museum Board.

Membership: R. D. Cooke—The Society extends greetings to the following new members received since the first of the year: C. M Prinslow, 544 N. 54th St., A. S. Hill, 620 N. 66th St., L. R. Allen, 3950 N. Farwell Ave., H. Olson, 4100 N. 24th Pl., J. E. Burke, University Club, S. Kalmbach, 1140 N. 37th St. The membership list now numbers 87. Approximately half have paid dues for the current year. It is necessary in order to properly carry on the work of the Society that the remaining members pay their dues promptly.

WORKING SECTIONS.

Variable Stars: H. Grunwald—The amateur astronomer can do something beyond "just looking," by studying stellar fluctuations of variable stars. These stars have been divided into three main classes, viz.: Cepheid or short period variables, long period variables, and irregular variables. These classes have been based on the units of time between successive maxima or minima of intensity of the star's light. The variable star section can furnish maps and instructions to any member interested in trying his skill in this fascinating field of work.

Occultations: R. D. Cooke—The following occultations will be visible at Milwaukee, longitude $5^h\ 52^m$, latitude 43°, during the February lunation. The times are Central Standard.

Date	Star	Mag.	Imm.	Pos. Angle	Moon's Age
2/18	47B Arietis	6.5	9:25 P.M.	75°	5 days
2/20	18 Tauri	5.6	5:20 P.M.	90°	7 days
2/22	107B Aurigae	6.5	7:30 P.M.	35°	9 days
2/25	mu Cancri	5.5	4:39 P.M.	170°	12 days
2/26	49B Cancri	6.0	12:43 A.M.	84°	12 days
2/28	48 Leonis	5.2	8:04 P.M.	121°	15 days

All of these occultations are not favorable for observing. Some are in partial daylight, some are near the full moon and some are near the horizon. It is desirable to have as many independent observations as possible. The only data needed are the time of the occultation to thenearest second and the location of the observer. We are interested in securing a few volunteers for computations in connection with this work. Those interested or who think they might be interested in either computing or observing of occultations are asked to communicate with R. D. Cooke.

Meteor Section: A. F. Boyd—Eight members of the meteor section gathered at the usual place for the Quadrantids on January 2, but were disappointed by the weather. There are no major meteor showers scheduled for February. The leader of this group wishes to convey the thanks of Dr. Charles P. Olivier of the Flower Observatory for the excellent work done by this group on the Leonid meteor shower. Dr. Olivier also stated that the final reports sent in were excellent form, and as a justified award our Mr. Armfield has been appointed Regional Director of the American Meteor Society.

CURRENT ASTRONOMICAL NOTES.

M. F. Wadleigh

If the sun got hotter: Novae represent celestial catastrophes. Our sun is one of this class. Isabel Lewis, in Nature Mag. Feb.

This eclipse ends the day before it begins: the total solar for the North Pacific on Feb. 13-14 will always be known as the paradox eclipse. Popular Astronomy, Feb.

Real astronomy for the amateurs: the amateur's proper fields of helpfulness specified and described. Isabel Lewis in Nature Mag. for Feb.

The new telescopic mirrors: or what we are missing by the use of silver for a reflecting surface. Description of the advantages and process, using superior metallic coatings. Henry N. Russell; Scientific Amer. Feb.

The new spot on Saturn: and how the amateurs beat the professionals to it. A professional consideration of this phenomenon. Scien. Amer. Dec.

Surprises, some astronomical; how the October meteors in Europe rivalled the 1866 Leonids. When to look for their reappearance. Jan. Sc. Amer. and Jan. Pop. Astron.

Coronal lines of the sun's spectrum found in a star; an event in discovery in this field. Also some suggestions for the "lucky guy" who is going to discover how to explain it. Jan. Sc. Amer., Russell.

The Expanding Universe: a hint to those who would know what this often used phrase signifies. Jan. Pop. Astron., also Sc. News Letter Jan. 13.

Planetary Phenomena in 1934: schedule for the year, particularly on the eclipses, with detailed drawings and maps. Herbert C. Wilson, Jan. Pop. Astron. Also contains planet notes for February, and occultation table.

"THROUGH THE EYEPIECE."

(Focusing your attention on events of the coming month.)

Joseph Loepfe.

Predictions are in Central Standard Time, corrected for this vicinity, and cover the month of February.

The Sun—Passes from the constellation Capricornus to Aquarius. It is moving north from declination -16° 51.4′ on Feb. 2, to -7° 15.8′ on Mar. 2. There will be a total eclipse of the sun on Feb. 13-14, invisible in Milwaukee but visible over sections of the Pacific Ocean and its path crosses the international date line, therefore the double date.

The Moon—Phases: Last quarter, Feb. 7, 3:22 A. M.; new moon, Feb. 13, 6:43 P. M.; first quarter, Feb. 21, 12:05 A. M.; full moon, Mar. 1, 4:26 A. M. Southernmost declination -27° 40.1′ at 3:00 P. M. Feb. 7, northernmost declination +27° 39.3′ at 7:00 P. M. Feb. 22.

Mercury—An evening star in Aquarius. Greatest elongation, east 18° 7′ Feb. 7. Conjunction with Mars, Feb. 8 and 27.

Venus—Passes from Capricornus to Aquarius and will be in inferior conjunction with the sun at 10:00 P. M. on Feb. 4 after which it will be a morning star, remaining so until Nov. 18.

Jupiter—Morning star in Virgo near Spica, rising at 10:57 P. M. Feb. 2, transit time 4:32 A. M. and on Mar. 2 it rises at 9:03 P. M. with a transit time of 2:39 A. M. In conjunction with the moon on Feb. 5. It begins its retrograde motion on Feb. 7. **Saturn**—Evening star in Capricornus. Morning star after Feb. 8. Unfavorably located for observation. **Uranus**—Evening star located in Pisces. **Neptune**—A morning star until 1:00 A. M. Mar. 2 when it will be in opposition with the sun; this is the most favorable time of the year for its observation. **Pluto**—Appears as a 15th magnitude star located in Gemini a few degrees south of Castor and Pollux. Arcturus rises at 9:56 P. M. on Feb. 2.

OUR MAGAZINE.

It is the opinion of a majority of the executive board that a publication of this kind will be in the interests of the society. It will disseminate information and articles of interest to the members of the society which cannot be discussed at our regular meetings. The executive board has, therefore, decided to publish this bulletin, and has appointed a publications committee to carry it through.

Can we put a magazine of this type across? There are many angles to be considered—material available, personnel, and finances. The financial end appears to offer the greatest problem. We cannot draw on the society's treasury for funds because of the low membership dues now assessed. Therefore the magazine must be self-suporting. We are charging less per copy than it costs to print and several members have consented to underwrite the publication to the extent of subscribing for several copies, but its continuation will depend entirely on the response of all the members. We are enclosing an addressed postal which we would like to have each one fill out and mail, expressing either their willingness to purchase several copies each month at ten cents per copy until our subscriptions fully take care of our printing bill, or to subscribe for the period of one year for $1.00.

At present, we have no name for the paper. Since it is your magazine, we want you to name it. In connection with the above mentioned card we are printing a line on which you may write your choice of name. Feb. 14 is the deadline for mailing your card, so think fast. The name chosen will appear at the head of the next issue with due credit to the submitter.

The Monthly Publication of the
Milwaukee Astronomical Society
Milwaukee, Wisconsin
E. A. de la Ruelle, President.
Miss Elizabeth Wight, Vice-President. L. E. Armfield, Secretary-Treasurer.

Vol. 1, No. 2 MARCH, 1934 Ten Cents

RESUMÉ

(Being a brief on the paper presented by L. E. Armfield, Jan. 1933)

THE GRADUAL UNFOLDING of the universe to the mind of man as traced through the long ages from the childish concepts of primitive man to the more or less infinite universe of today is the historical background of the paper, "The Architecture of the Universe, Old and New", which is on file at the society's library.

As far in the remote past as science can trace, man's impression of the sun, moon, and stars is found traced in imperishable characters on the face of stone. When ancient man's intellectual twilight brightened into daylight, through the sunbeams of knowledge, his conceptions of the universe began to assume analagous proportions, such as described during the times of the Egyptian philosophers who pictured the universe in the shape and form of their own land, a great parallelogram, long from north to south, narrow from east to west.

From these first meager attempts to interpret the structure of the universe, the paper follows the history of astronomical knowledge through the era of the intellectual Greeks, the dark ages, the bursting of the celestial barriers by Galileo with his invention of the telescope, the explorations of Sir William Herschel, and finally reviews the almost inconceivable vastness of the universe as established by the astronomers of today.

The three classical theories of the Galactic System are discussed in detail in the paper, but may be summarized as follows:

1. The system of the Milky Way is a single spiral structure, some 200,000 light years in diameter, outlined by globular clusters. The sun is placed near the center of one of its star clouds, the local system, about halfway between the massive center and the edge of the great system.

2. It is a super-galaxy outlined as before by the globular clusters. The local system and other star clouds are separate galaxies comparable to the external systems.

3. It is a single spiral, 30,000 light years in diameter, comparable to the largest external spirals. The sun is placed not far from its center. The spiral is situated near the edge of the great system of globular clusters.

A brief review of the Magellanic clouds is presented before studying the external systems of galaxies in order to call the reader's attention to their unique location in respect to the local and external galaxies.

The study of the Extra-Galactic Nebulæ is brief, but nevertheless carries one across the void to the very outposts of space which are open to inspection by the 100 inch Mt. Wilson telescope. The penetrating power of the 100 inch is staggering to the imagination. iWth this instrument thirty million galaxies, some of which are as remote as 250 million light years, are exposed to the scrutiny of modern astronomers.

—Mrs. L. E. Armfield.

Subscription price $1.00 per year of 12 issues. Contributions are solicited but cannot be paid for. Their publication, either in whole or in part, is solely at the discretion of the committee on publications. Address all comunications to the secretary of the society, Mr. L. E. Armfield, 2046 S. 59th St., Milwaukee, Wis.

THE JUNIOR AUXILIARY

During the past month telescopes which were constructed by Junior members have been on display at the West Allis High School and in the lobby of the Y. M. C. A., the latter through cooperation with the Milwaukee Hobby Council, with which the society is considering affiliation.

There are two telescopes under construction by Juniors; a four inch by Ray Cooke, nearly completed, and a four inch by Carl Reichert, which is also very nearly ready for use.

The program for the April meeting will consist of the following papers: "The Origin of the Solar System" by Louis Schilhanel, and "Scientific Oddities" by Robert Bonebreak.

STANDING COMMITTEES

Program — L. H. Mathias, chairman.
Publicity — H. W. Cornell, chairman.
Membership — R. D. Cooke, chairman.

No definite announcement for the April meeting can be made at this time due to the fact that negotiations are underway, through the courtesy of the University of Wisconsin, Extension Division, to have Dr. Joel Stebbins, Director of the Washburn Observatory, Madson, Wisconsin, as guest speaker. Definite announcement of time, place, and program will be made in the usual manner.

The Society extends greeetings to the following new members enrolled during the month of February: S. A. Major, 1946 N. 12th St., A. Esche, 1817 N. 5th St., B. H. Lincke, 1333 N. 17th St., C. F. Jensen, 1444 Summit St., Racine, Wis.

We would like to call your attention to an unusual book recently published. It is an autobiography entitled, "An Astronomer's Life", and was written by Prof. Edwin B. Frost. It is not merely a book for people with an interest in scientific matters or in astronomy, but is a book about people and the business of living and is written with the charm that characterizes Prof. Frost's entire life. It is well worth the attention of all members. For those who wish to purchase it, and the price is surprisingly low, Miss Wight can secure a reduction in price if there are enough orders.

WORKING SECTIONS

Variable Stars: H. L. Grunwald — Maxima 270 of SS Cygni (Designation 213843) was observed in January after the star had remained at minima for seventy days. The maxima was of the broad "A" type in which the star reaches its maxima of 8.5 magnitude within a day and then gradually tapers off to its minima in about 15 to 20 days. Following this minima, a maxima of the narrow type usually occurs rising in the same way but receding in a much shorter time. This star is too close to the sun for observation during this season.

Spring again presents the opportunity of observing the star RX Lyrae (Designation 185032). Its proximity to the famous Ring or Doughnut Nebulae in Lyra makes it an easy object for the beginner. The range of magnitude is from 11.7 to 15. Although it is invisible with a small telescope the greater part of the time, its sudden appearance at the time of its maxima makes this an interesting field to observe. The period of this variable is 249 days. During March 1934 this star will be between the 12th and 14th magnitudes.

Occultations: R. D. Cooke — The following occultations will be visible at Milwaukee, longitude $5^h\ 52^m$, latitude 43°, during the March lunation. Only dark limb immersions are given. The times are Central Standard.

Date	Star	Mag.	Imm.	Pos. Angle	Moon's Age
3/26	X Cancri	6.2	2:38 A. M.	118°	11d
3/28	d Leonis	5.1	5:35 P. M.	125°	13.5d

Meteors: C. C. Steven — Charles C. Steven has taken over the direction of the Meteor Section and it is hoped that the response from the society will be greater than ever this coming year. No showers of particular magnitude are expected in March, but it is suggested that the members interested in this type of work familiarize themselves with the following constellations so that they may be prepared for the Lyrid meteor shower, which is expected April 21: Lyra, Hercules, and Cygnus. The radiant point is near Vega in Lyra. A little study of this section of the sky beforehand will make actual observations much easier and of greater value.

Real heights of a fireball reduced from observations made by members of the meteor section, Mrs. L. E. Armfield and Joseph Loepfe, are as follows: beginning height, 146.1 miles, ending height, 42.5 miles, average velocity, relative to the earth, 34.5 miles per second.

The above observation and computation shows that actual work is being done by this section and that the society is doing something toward real contributions to professional astronomy.

CURRENT ASTRONOMICAL NOTES
M. F. Wadleigh

The Temperature of the Meteorites; C. C. Wylie; Pop. Astron. Feb. A paper on the research for authenticity of the reports current now and then regarding the high temperature of freshly fallen meteorites. It is based on the results of much investigation and also gives a little consderation to the matter from the theoretical standpoint.

The 200 inch Telescope Mirror; Science News Letter; Jan. 27. The "world" is waiting for the successful completion of this job. A new and better glass has been perfected. This task, it should be realized, is possible to us as a result of one of the few benefits of the World War, that of the development of optical glass making.

The Fels Planetarium of Philadelphia; Scientific Mon. Feb.; A description of the new addition to the Franklin Institute, with exterior and interior photo-prints.

The new Spot on Saturn; Henry N. Russell; Sc. Amer. Dec.; Here is another triumph for the amateur discoverer. First seen last August by an English brother sky-sweeper. The discovery again centers interest in the speculative possibilities as to the atmospheric natures of our large planets. A thoroughly attractive subject, as Russell shows.

As a novelty suggestion, calculated to arouse any astronomer to inventive heights, read the plan of L. J. Bulliet. A device is suggested to eliminate the necessity for an observer giving constant attention to the guiding of a photographic telescope. Sc. Amer. Feb.

"THROUGH THE EYEPIECE"
J. F. Loepfe

Predictions are in Central Standard Time, corrected for this vicnity.

The Sun — As it moves northward, crosses the equator at 1:28 A. M. Mar. 21. This marks the beginning of Spring and is known as the Vernal Equinox, "Vernal" meaning spring and "Equinox" meaning equal nights. It is also the time when the sun is at the "first point of Aries" and begins its journey through the constellations of the Zodiac. During this month the sun will pass from Aquarius to Pisces.

The Moon — Phases: Last quarter, Mar. 8, 12:06 P. M.; New Moon, Mar. 15, 6:08 P. M.; First quarter, Mar. 22, 7:44 P. M.; Full moon, Mar. 30, 7:14 P. M.; Southernmost declination, Mar. 8; Northernmost declination, Mar. 12; Apogee (farthest distance from earth) Mar. 24.

Mercury — Evening star until 6:00 P. M. Mar. 5, when it will be in inferior conjunction with the sun, after which it appears as a morning star. Visible during the end of the month in the morning twilight; located between the sun and Venus. Greatest elongation, west 27° 49′ on Apr. 2.

Venus — Morning star, reaching greatest brilliancy Mar. 11, magnitude −4.4. In conjunction with moon, Mar. 12, and with Saturn, Apr. 1 at 9:00 P. M.

Mars — Evening star, visible in the twilight and gradually approaching conjunction with the sun, which will occur during April.

Jupiter — Morning star, in Virgo. Conjunction with Spica, Mar. 13. Also conjunction with moon, Mar. 4 and Mar. 31. Rises Mar. 2 at 9:03 P. M. and transits at 2:39 A. M. It is retrograding all during the month. **Saturn** — Morning star, not well placed for observation. Rises during morning twilight after Venus and before the sun. **Uranus** — Evening star, gradually approaching conjunction with the sun. **Neptune** — Evening star in Leo. **Pluto** — Evening star of the 15th magnitude, located in Gemini.

"CROSS HAIRS"
(Being a column of personal notes, all in fun)

Due to the small response to our request for suggestions as to the name of our magazine we are postponing any definite selection until next month. If you didn't send in your card, do so at once.

Walter (Scotty) Houston, J. C. Gamroth, and Ed. Halbach are upholdng the reputation and, we hope, the dignity of the M. A. S. out at Madison. All three have done good work on cooperative observing of meteor showers.

We're expecting some good movies of the building operations of the Observatory from Stamm and Cooke. If they think that taking pictures will let them out of some of the constructional work, they're due for a real change of mind. How do you like handling the rod in a gale, R. D.?

CLASSIFIED ANNOUNCEMENTS

Commercial — Two cents per word.
Individual — One cent per word.

Commercial.

Eyepieces: We have in stock a number of eyepieces of one-half inch and one inch focus at $3.00. One and three quarter inch focus made to order at $4.00. We are also prepared to furnish eyepiece adapters, finders and graduated circles to your design. Prices on application. R. D. Cooke, 6811 Cedar St., Tel. Bi. 4540 .

Individual.

A four inch reflecting telescope with mounting, $5.00, or will trade for working model engine or short wave parts. Delbert Bude, 817 S. 57th St., Tel. Greenfield 1363.

METEOR OBSERVATIONS

E. A. HALBACH

The amateur astronomer has been assisting the professional astronomers in obtaining information about meteors by observing the hourly rate of appearance, the height of the beginning and the end of the trail, and distance and velocity of travel of the separate meteors. The first is obtained simply by counting. The heights are determined by observing and recording the beginning and end points of the meteor's path as seen simultaneously from two observing stations miles apart. Knowing the distance of travel from the observed trail and observing its duration, the velocity of travel may be obtained.

Observers at Fuertes Observatory of Cornell University have constructed an instrument to simplify the determination of the duration. It is a plane mirror, mounted so that it is given a slight wobbling motion by a small motor. The image of a star desribes a small ellipse about one degree in diameter, at the rate of ten times a second. By persistence of vision the stars thus appear as thin rings of light. Seen in the mirror a fast moving meteor will appear to describe a wavy curve, the distance between the successive crests corresponding to one-tenth of a second's motion. For slow moving meteors moving through less than the diameter of the ellipse in this time, the apparent path will be looped. Thus both from the shape of the observed track and the distance between successive waves or loops, the rate of the meteor's apparent motion may be found. Knowing its distance (from observation at the second station) the real speed may be ascertained.

Although the observers at Cornell used the mirror with telescopic observations of meteors, a similar instrument for direct observation has been constructed for our society by one of its members.

OBSERVATORY NEWS

The members of the Observatory Committee, as well as a number of the members of the society, have proved the fact that amateur astronomers can be converted into very efficient rodmen at very short notice, when aid is required to take levels on the site of our proposed observatory. It has been said that, "The better the day, the better the deed," so Sunday morning, January 28, 1934, was selected for this work. The committee wishes to thank all these fellows for their enthusiastic and earnest cooperation in completing this preliminary portion of the work.

The topographic map which was made as a result of this work, shows that there is available, a tract of land about seventy feet in width and about one hundred ninety feet in length, which is practically level, located on the summit of a ridge running diagonally across the observatory site. The highest point on the site is twenty-three feet higher than the grade of the road abutting the property and is situated approximately two hundred feet northerly therefrom.

All the preliminary field information has now been obtained, thereby clearing the track for the working out of the detailed plans which are gradually taking form.

It is rumored that one of our members is preparing a scale model of the proposed observatory building and instrument. This may be a little advance information. Nevertheless its appearance is being eagerly awaited.

If the enthusiastic and determined efforts thus far shown can be used as a criterion, the accomplishment of our purpose and the scientific results which will be obtained should follow as a natural consequence.

The society at large can be justly proud of the work done by the committee and the hearty cooperation of the active members.

The Monthly Publication of the
Milwaukee Astronomical Society
Milwaukee, Wisconsin
Vol. 1, No. 3 APRIL, 1934 Ten Cents

THE DEVELOPEMENT AND MANUFACTURE OF OPTICAL GLASSES

H. G. THOMSON
(Formerly of the Optical Glass Section, U. S. Bureau of Standards.)

Ordinary glass was known to the ancients and has been manufactured for centuries. It answered the needs of mankind for ages, until the scientists of more modern times became aware of optical phenomena, their compositions including the better glasses. Optical glasses are quite complex, their compositions including the oxides of sodium, potassium, calcium, silicon, boron, lead, barium, zinc, and arsenic. The compositions of the various glasses depend upon the requirements of the index of refraction and dispersion of the optical system in which the glasses are to be used.

The development of optical glass in this country was brought about as an absolute necessity during the World War, when our source of supply in Germany was cut off, and our army and navy would have been terrifically handicapped without their telescopes, binoculars, cameras, periscopes, and rangefinders.

The government enlisted the aid of the staff of the Geophysical Laboratory of the Carnegie Institute in Washington to take charge of the development of several types of optical glass. This staff of scientists was experienced with naturally occuring and synthetic silicates, but there were many problems connected with optical glass manufacturing to be worked out. These men were placed in the plants of Bausch & Lomb Co., Spencer Lens Co., Corning Glass Co., Pittsburgh Plate Glass Co., and the U. S. Bureau of Standards. Within a very short time they were making usable glass on quantity production. The credit for the early development of optical glasses is given to these men.

The U. S. Bureau of Standards worked on optical glasses from early war days and made a very valuable contribution in the development of a superior porcelain glass melting pot which withstood higher temperatures and greatly increased production and improved the quality of glasses. The Optical Glass Section was moved from Pittsburgh to Washington after the war and development has been carried on since that time as well as the maintenance of a small scale production plant which produces "Replacement Glass" for the U. S. Naval Optical Shop.

Optical glass is produced under the most rigid specifications, each melt having as an objective a certain index of refraction and dispersion; always aiming to obtain the highest possible transmission. Pure chemicals are very essential in making first quality glass; such impurities as iron oxide or any others tend to give color to the glass and reduce the transmission, and decolorizers such as manganese dioxide or selenium, though very effective in producing colorless glasses, still further reduce the transmission of light.

The index of refraction and dispersion of glasses are dependent upon composition, each constituent of the glass contributing its part to make up the total. The magnitude of the effect each constituent may have on the index of refraction varies directly with weight. However, the degree of effect that any one of the various constituents may have on these two characteristics is not a straight line function of its composition, which tends to complicate calculations for the maker.

The glasses are melted in porcelain pots having a capacity of 1000 to 1500 pounds of glass depending upon the composition. The melting is carried out in regenerative, open, gas-fired furnaces at temperatures ranging from 1300 to 1475 degrees Centigrade, the temperature being raised until *(Continued on Page 15.)*

The Official Monthly Publication of the Milwaukee Astronomical Society
2046 S. 59th St., Milwaukee, Wis.

The next regular meeting of the society will be held at the University of Wisconsin, Extension Division, Friday, May 4, at 8 P. M. At this meeting L. E. Armfield will present his paper on "Meteors". The paper is, in part, a summary of the work done by the meteor group of the society, and should prove of interest to all.

The society has of late been receiving a good deal of publicity in the columns of the daily press. We have our publicity committee to thank for these articles and we hope that the good work will continue.

The society extends heartiest greetings to T. R. Hedengren, 2854 S. Herman St., who enrolled as a member at the March meeting.

CURRENT ASTRONOMICAL NOTES

M. F. WADLEIGH

The Third Largest Piece of Glass Ever Made; Pop. Astro., Feb. Even the "third largest" is a matter of no small interest. Each problem of this sort is rich in experience for use in conquering greater problems.

One Chance in a Hundred to Understand Einstein; J. B. Nichols, Scien. Amer., Feb. The close relations of the discoveries of Einstein to the subject of astronomy makes the whole matter alluring. This is not a technical article, but about the literature on the subject.

A twelve foot 'scope goes sight-seeing about the country on a foursome of low pressure Jumbo tires. Scien. Amer., Feb.

Notes on Stellar Photography; Pop. Astro., March. Stellar photographers come to the front in this article by H. C. Levinson. This should prove helpful to those interested in this branch of the science.

What is a Fifty-pound Weight?; Scien. Mon., Feb. A discussion, both explanatory and historical, dealing with the origins and present status of our weight systems. Of interest to astronomy students for the dependence of both ancient and modern system makers on the measurement of the meridian.

Sun Dials and Their Construction, I; Mayall and Mayall; Scien. Amer., Feb. Popular interest in dials is increasing and the interest is not all in one aspect. The job is enticing from the artistic, the practical, and the scientific sides. One of the writers is a research assistant at Harvard College Observatory.

Elbow Room for Molecules; Dr. Hubble at Mt. Wilson took 1283 photographs of two per cent of the visible sky. Calculations show that at the same rate, the whole universe would contain 75,000,000 nebulæ. Prof. McMillan, of Chicago U., then figures that all the molecules evenly distributed could be allowed seven feet in which to squirm.

Ten cents per copy, $1.00 per year. Contributions are solicited but cannot be paid for. Their publication, either in whole or in part, is solely at the discretion of the committee on publications. Address all communications to the secretary of the society at the above address.

WORKING SECTIONS

Variable Stars: H. L. Grunwald — At a meeeting held on Friday, March 16, the variable star section mapped its program for the next few months. Every observer will give an account to the leader of the section each month showing the number of fields observed and the number of observations made during the month. This information will be tabulated and as much of it published in subsequent issues of this paper as space will permit. In addition to this, lists of predictions covering the more popular fields will be published.

A general discussion on several fields was contributed by W. S. Houston and the details involved in locating the fields were described.

One of our members presented blueprints made from tracings of a number of fields. These can be obtained at a very nominal cost to the interested members. The fields were selected especially for new observers and each contains some naked eye star or conspicuous object such as a cluster or nebula.

Through the combined efforts of the members in the section we look forward to establishing a name for the Milwaukee Astronomical Society among variable star observers.

The following predictions are given for April, 1934. The letters following denote increasing or decreasing in reference to magnitude.

Brighter than 8.0 magnitude, for small telescopes: 070122a R Geminorum (D), 184205 R Scuti. From 8.0 to 10.0 magnitude, for telescopes of 3″ aperture: 004958 W Cassiopeiæ (I), 052034 S Aurigæ, 054920a U Orionis (D). From 10.0 to 12.0 magnitude, for telescopes 4″ to 8″ aperture: 031401 X Ceti (I), 042215 W Tauri (D), 052404 S Orionis, 053005a T Orionis, 213843 SS Cygni, 230759 V Cassiopeiæ (D), 230110 R Pegasi (D), 223841 R Lacertæ (D).

Occultations: R. D. Cooke — The following occultations will be visible at Milwaukee, longitude $5^h\ 52^m$, latitude 43°, during the April lunation. Only dark limb immersions are given. The times are Central Standard.

Date	Star	Mag.	Immersion	Pos. Angle	Moon's Age
April 20	187B Gemin	6.3	9:54 P. M.	77°	6 days
April 20	192B Gemin	6.3	11:33 P. M.	164°	6 days

We have a good group now preparing to work on predictions and reductions. Reducing occultation observations is exceedingly interesting work for you mathematically minded fellows. We would like now to get as many as possible to volunteer for observing occultations. If you have a telescope and a stop watch please step forward.

Meteors: C. C. Steven — On April 21 the Meteor Section of the society plans to continue its work in meteor observing. At this time we are to observe the meteors of the Lyrid shower. Tentative arrangements made at a meeting of the group on April 6 call for the following program:

One or more spectroscopic stations headed by E. A. Halbach and C. P. Frister;

Two photographic stations, five miles apart, manned by L. H. Matthias, M. J. W. Phillips, A. Fotsch, and H. Stamm;

Two telescopic stations, two miles apart, with L. E. and Mrs. Armfield and H. L. Grunwald at the eyepieces;

Three visual stations, one at Port Washington, one at Racine, and one at Watertown, where it is hoped that conditions will permit the following veterans and others to cooperate: F. and Mrs. Dieter, Wm. and Mrs. Liebscher, Mrs. Stauber, Miss Wight, A. F. Boyd, H. W. Cornell, M. M. Feinsilber, J. C. Gamroth, W. S. Houston, A. S. Hill, A. L. Peck, C. M. Prinslow, C. Sietmann, C. C. Steven, T. Thompson.

EYEPIECES

J. C. MEYER

The most commonly used forms of eyepieces, range from a simple lens to the triple applanat, the best of which were designed by the late Prof. Hastings.

To correct for color in a single lens a plano-concave lens of flint glass is cemented to a double convex lens of crown glass. This affords an almost complete correction for color.

Another method for obtaining a magnified image free from color and spherical abberation is contained in the Ramsden and Hygenian eyepieces, the Ramsden consisting of two lenses, plano-convex with the convex sides facing each other, and the Hygenian consisting of two convex lenses with the convex sides of both lenses facing the objective or mirror.

The Kelner eyepiece is a modification of the Ramsden in that it consists of two plano-convex lenses but the eye lens is made the same as the simple lens which is corrected for color.

The ultimate in eyepieces is the triple applanat which is a combination of three lenses cemented together, thus providing a lens system which is free from internal reflection, color, and which is applanatic.

The simple lens, simple lens corrected for color, Ramsden, Kelner, and the triple applanat are "positive" eyepieces, that is — the primary image is formed outside the eyepiece. The Hygenian is the only "negative" eyepiece and is so classed because the primary image lies between the two lenses of the eyepiece.

The simple lens may be used as an eyepiece if the quality of the image presented to the eye or photographic plate does not have to be free from color and lack of definition. Two simple bulls-eye lenses may be used for an eyepiece if necessary and the image at the center of the lens will be quite satisfactory for some visual purposes.

OBSERVATORY NEWS

The model of the proposed observatory and sixteen-inch reflector with fork type mounting referred to in our last issue was placed on exhibition at our last meeting. The model is the result of the expert craftsmanship of our R. D. Cooke, chairman of the instrument section of the Observatory Committee.

In evidence of the increasing popularity that astronomy is gaining throughout the country and especially in Milwaukee, the society's exhibit at the Y. M. C. A. caused such a great response that similar requests have been received for the exhibit in other prominent places in the city.

The unusually large attendance at the Public Museum lectures given by members of our society also demonstrates the remarkable interest shown in the subject. The structure of the universe and the wonders of creation are things one reads about but very few people ever see for themselves. The requests that are made for use of the instruments belonging to the members of the society prove how real is the public desire for observing facilities, and it is for this reason that the society presents the desirability of a public Astronomical Observatory to be located in one of the public parks.

This observatory should be located at a point where the visibility is good and should be used primarily for public instruction, and in the higher sense of the term, for public entertainment. It should be of such a kind as to reach the maximum number of people, not restricted to professional astronomers and scientists. It should be a people's institution where ample facilities for lectures and class instruction for the public would be provided.

Milwaukee is growing rapidly and should have an observatory commensurate with its cultural growth.

The New Surfaces for Telescope Mirrors

L. H. MATTHIAS

Telescope mirrors of glass have generally been coated by chemically precipitated silver. The silver coating has the desirable property of taking a very high polish and of having the highest reflectivity in the visual portion of the spectrum of any known metal or alloy. However, the reflectivity falls off rapidly at short wavelengths and consequently for photographic and spectroscopic work a silver surfaced mirror is not entirely satisfactory. Silver also tarnishes rapidly when exposed to ordinary atmospheres and the reflectivity falls more for short than for long wavelengths. Lacquering has been resorted to in many cases to protect the silvered surface but this has the disadvantage of reducing the reflectivity of a freshly silvered surface from about 0.92 to 0.7.

Some other metals and alloys which are more suitable than silver from the standpoint of tarnishing and hardness and high uniform reflectivity throughout the useful spectrum are aluminum, Mach's Magnalium, and chromium. Although none of these metals have the high reflectivity of a freshly silvered surface in the visible portion of the spectrum they have a higher reflectivity than even slightly tarnished silver, and do not deteriorate nearly as rapidly.

To deposit these metals on a telescope mirror with the requisite uniformity and surface condition requires a much different method than the silver precipitation process. These metals can be successfully applied by evaporation in a high vacuum, the process consisting simply of the formation of an atmosphere of the metal vapor to be deposited in a highly evacuated chamber in which the mirror is placed. This process has been used in laboratories for preparing thin films of various materials for years but it is only within the past year or more that it has been applied to telescope mirrors. The actual process consists in suporting the mirror, usually face downward, above the bottom of a large vacuum tight vessel. At some distance below the mirror are placed wires of the metal to be evaporated, or a crucible in which the metal is placed, either of which is arranged to be heated electrically. Some investigators also employ a high voltage between the metal to be evaporated and another electrode symetrically placed in the vacuum chamber with respect to the surface to be coated for the purpose of obtaining a rough indication of the rate of evaporation of the metal.

The pressure in the vacuum chamber must be low enough so that the evaporating molecules do not collide with gas molecules in their transit from the heated metal to the mirror surface. In other words, the mean free path should be greater than the distance between the evaporating metal and the mirror surface. At a pressure of about one one-hundred-millionth of an atmosphere the mean free path is approximately 1000 cm. This is sufficient to obtain a film with the desirable properties. To obtain this pressure requires the use of a condensation pump in addition to an oil vacuum pump, and the use of either liquid air or carbon dioxide snow to prevent the mercury vapor from the pump from entering the vacuum chamber. When the required vacuum is obtained the metal to be evaporated is slowly heated, electrically, to a sufficiently high temperature to evaporate. The heating is continued until the required thickness of film is deposited.

These thin films possess remarkable hardness and resistance to corrosion and it is anticipated that they will shortly supplant the silver used at present. The individual amateur will doubtless find the necessary equipment for applying these coatings too costly and will doubtless be satisfied to send his mirrors to someone making a business of applying surfaces by this method.

THE JUNIOR AUXILIARY

The study of Circumpolar and spring constellations is being taken up by the Juniors with the aid of star charts obtainable from the Royal Astronomical Society of Canada for one cent each.

Membership cards are now being presented to all Juniors who have paid their dues, which amount to twenty-five cents per year. The money is used for the purchase of charts, sending notices to members, and for other necessities which may arise.

The May meeting will consist of a paper on the Yerkes Observatory, by John Wall, and an illustrated talk on the planets by J. F. Loepfe.

Through the Eyepiece

J. F. LOEPFE

Predictions are in Central Standard Time corrected for this vicinty.

The Sun — Located in the constellation Pisces. Enters Taurus April 20.

The Moon — Phases: Last Quarter, April 6, 6:48 P. M.; New Moon April 13, 5:57 P. M.; First Quarter, April 21, 3:20 P. M.; Full Moon, April 29, 6:45 P. M. Southernmost declination, May 2; Northernmost delcination, April 18. Perigee, April 7, 230,190 miles; Apogee April 20, 251,200 miles.

Mercury — Morning star, not well placed for observation. In conjunction with the moon April 11, 9:40 P. M.

Venus — Morning star in Aquarius. Greatest elongation west, 46° 18′ April 16. In conjunction with the moon April 10, 3:22 A. M.

Mars — Evening star until April 14, at 8:00 A. M. when it is in conjunction with the sun. After this it will appear as a morning star.

Jupiter — Morning star until April 8, at 3:00 P. M. when it is in opposition with the sun. After this it will appear as an evening star. In conjunction with the moon April 27, 7:53 P. M. Rises at 6:30 P. M. April 6. Now is the most favorable time of the year for its observation.

ECLIPSES OF JUPITER'S SATELITES.

D - Disappearance. R - Reappearance.

APRIL					APRIL				
d	h	m	Sat.	Phen.	d	h	m	Sat.	Phen.
11	0	16	I	D	26	22	32	II	R
12	18	44	I	R	MAY				
14	18	32	II	R	4	0	26	I	R
19	20	38	I	R	4	18	57	III	D
21	21	08	II	R	4	21	13	III	R

Saturn — Morning star rising just before Venus. In conjunction with the moon April 9, at 2:10 P. M. *Uranus* — Evening star until April 17 after which it becomes a morning star. It is too near the sun this month for observation. *Neptune* — Located in Leo, Right Ascension, April 15, $10^h\ 47^m$, declination 8° 41′ North. *Pluto* — Evening star of the 15th magnitude, located in Gemini.

Note — We are printing for the first time a few of the phenomena of Jupiter's satellites visible at Milwaukee before and shortly after midnight. If there is sufficient interest manifested they will be continued, and possibly enlarged upon, during Jupiter's period of best visibility.

We are highly honored in having Dr. Stebbins with us this month and we know that our members will have new interest in affairs astronomical after his visit. It isn't often that we have the opportunity of hearing about the inside working of observatories such as Washburn.

The society has received from the disbanded Godfrey Club of Watertown, Wis., its library consisting of many helpful books, bound magazines, pamphlets, and pictures. They are now in our library.

(Continued from Page 9) the molten mass is sufficiently fluid to allow of easy escape of gas bubbles. The melting process is carried out under oxidizing conditions only, as it is impossible to free the melt of bubbles if the furnace atmosphere is even slightly reducing.

The batch is fed into the pot at intervals until the pot is filled and as soon as the batch has melted the stirring process begins. Optical glasses must be very carefully and thoroughly stirred, first, to rid the glass of bubbles or "seed" and second, to hasten the complete solution of all the constituents and eliminate as much as possible the formation of stria, which are lines of inhomogeniety in the glass and which cause distortion. First quality optical glass must be free of stria which have a different index of refraction than the glass immediately adjacent. Consequently, the stirring process is given the greatest care, first at the high temperatures to make sure that all the batch is in solution and that the pot wall is swept clean, and then as the temperature is reduced to about 1100 degrees Centigrade the stirring is drawn toward the center of the pot so that stria caused by solution of the pot wall will not be drawn into the rest of the melt. The glass is stirred with a water cooled iron rod inserted into the end of a porcelain thimble which extends through the melt to the bottom of the pot, or by means of the iron rod without any protection, which results in stirring with a glass rod because a layer of glass congeals on the cold surface of the rod. When the glass has cooled to 1100 degrees Centigrade, the pot is removed from the furnace, set up on bricks and a jet of cold air is blown against the bottom to hasten the cooling and to retard the convection currents which draw the stria from the glass next to the pot wall into the center. When the glass has cooled sufficiently to crack on the surface the pot is covered with loose insulation and allowed to cool for several days.

The pot is broken open when cooled and the glass separated from the potshell. The glass is then inspected for stria, stones, cords, or bubbles. These imperfections in the glasses are more easily observed by transmitted light when the specimen is immersed in a liquid having the same index of refraction as the glass itself. Fine stria are sometimes very difficult to find in the raw glass and do not show up until after the glass has been moulded into blanks.

The inspected glass is advanced to the lens or prism blank form by either of two ways: 1. By melting down and annealing large pieces of glass into slab form, from which the blanks may be cut, or 2. By melting down weighed pieces of glass on the end of a punty rod in a small furnace, cutting the glass from the rod with a pair of scissors into a heated steel mold and pressing to shape. The blanks, in either case, must be carefully annealed before being ground and polished.

In the annealing process the blanks are placed in an electric annealing furnace, which usually consists of a heavy Nichrome box surrounded with heating elements. The furnace is adjusted so that the rates of heating and cooling can be very carefully regulated. The glass is packed in silica sand as an aid to prevent warping. The annealing temperature depends upon the size of the blanks and the type of glass and the annealing schedules must be made to fit the largest and most difficult piece in the charge. The annealing process consists of heating the glass to some temerature just short of its deforming temperature and holding it at this point until all strain is released after which the glass is slowly cooled through the critical range. It is in this operation that much time is consumed, running into months to anneal large telescope reflectors.

(A subsequent article by Mr. Thomson will describe the methods used in grinding and polishing the larger, professional reflectors.)

The Mas Bulletin

Vol. 1, No. 4 | May, 1934 | Ten Cents

ABSTRACT

("The Geography of the Heavens", by M. F. Wadleigh, January, 1933.)

THIS paper compares the students of astronomy, searching the skies for objects of various interests, to naturalist travellers and navigators exploring the seas and continents whether for glory, for excitement, or for the intrinsic values of the objects of their discoveries. Like terrestrial wayfarers, they follow the trails blazed by the pioneers who went before, extending the frontiers, verifying previous reports, bringing back strength and encouragement to newer enterprises.

"The student is a traveller, and, although transported by no sturdier craft than his own courageous and wide-eyed imagination and supplied and equipped with no other funds in reality than those that limitations of print upon parchment, and charts and globes allow, he may weigh anchor within the four walls of his homely study, sails filled with anticipation, and fare forth to colorful discovery."

Due attention was then paid to the instrumental aids with which the sky-traveller inspects and determines his various findings, with especial respect paid to the power of the telescope to unfold the unseen, undreamed-of wealth of celestial objects.

The paper then proceeds to guide a novice on a sight-seeing tour of a section of the heavens by methods corresponding to different methods of travel. In doing this, some of the crude instruments necessary to help in guiding the eye of the student from star to star, including major points of the principles of mapping the celestial sphere, are described. The uses of these aids are described in connection with references to certain stars in illustration. In this exposition the system of Right Ascension hour meridians and Declination circles, the axial inclination and equinoxal intersections are included.

The journey through the heavens was then begun with the great stars of the constellation of Orion, because of its prominence in the winter sky, as the "point of departure". A special "stop-over" was made for the contemplation of the magnificent spectacle of the Great Nebula. As the journey proceeds across the inconceivable spaces we chart our way and take bearings in terms of the compass and the hour and declination positions, noting also as we travel that the recognized boundaries of the constellations are crossed one after another as one enters a "new country", Taurus being the next to be visited, with Aldebaran in view. Then the Hyades, then the Seven Sisters, then the Demon Star, Algol, and with the sighting of Mira, we choose to call it a hard day of sight-seeing well spent, and hasten to our "hammocks" upon the good advice of the Old Skipper Morpheus.

Sight-seeing in the heavens is just as much of a task as that of terrestial roaming, and leads to dizzy heads and weary eyes as one becomes surfeited with the multitude of sights. "More than seventy countries (constellations) still beckon the intrepid and exhaustless mariner. But it is too much to expect in one evening if we would court lasting acquaintance. Each country possesses many a port-of-call, many a beacon. — A single constellation offers a splendid goal of contented study, whereby will be attained a ripe acquaintance with the various tools and instruments, and, at the same time, familiarity with each of the magnificent spectacles viewed."

The Official Monthly Publication of the Milwaukee Astronomical Society
2046 S. 59th St., Milwaukee, Wis.

The next meeting of the society will be held at the University of Wisconsin, Extension Division, Friday, June 1, at 8 P. M. Definite announcement of subject and speaker will be made by postal. Those desirous of receiving such announcement should see that the secretary has their name, address and dues before the 15th of the present month.

The following new members have been enrolled during the last month: K. Sharp, 2571 N. 51st St., Carolyn Nickels, 2190 N. Richards St., A. E. Seebach, 2474 N. 50th St., E. A. Brugger, 3108 N. 45th St., H. Becker, 2453 S. 29th St., E. H. Bruce, Kearney & Trecker Corp., West Allis, E. Arndt, 3359 N. 25th St.

WORKING SECTIONS

Variable Stars: H. L. Grunwald — The following list of predictions is given for May, 1934: Brighter than 8.0 magnitude; 162119 U Herculis (D), 184205 R Scuti. From 8.0 to 10.0 magnitude; 004958 W Cassiopeiæ, 052034 S Aurigæ, 170215 R Ophiuchi (I), 184205a R Geminorum (D), 230759 V Cassiopeiæ (I). From 10.0 to 12.0 magnitude; 160021 Z Scorpio (I), 213843 SS Cygni. From 12.0 to 14.0 magnitude; 164715 S Herculis, 185032 RX Lyræ, 163137 W Herculis.

The unsettled weather during the past month made observing difficult and there was little opportunity to instruct new observers at the telescope. We look forward to clear skies during May and plan to get the beginners started on a summer observing schedule. A good number of the charts mentioned in our last report are at hand and we urge those interested in variables to ask for them.

Occultations: R. D. Cooke — The following occultations will be visible in the vicinity of Milwaukee during the May lunation. These are only the immersions occuring from new moon to full moon. Several of these are quite favorable and every effort should be made to observe them.

Date	Star	Mag.	Immersion CST	Pos. Angle	Moon's Age
May 20	18 Leonis	5.8	9:42 P. M.	79°	7½ days
May 20	19 Leonis	6.4	10:22 P. M.	98°	7½ days
May 20	R Leonis	var	10:32 P. M.	114°	7½ days
May 25	370B Virg	6.0	1:28 A. M.	108°	12 days

Ten cents per copy, $1.00 per year. Contributions are solicited but cannot be paid for. Their publication, either in whole or in part, is solely at the discretion of the committee on publications. Address all communications to the secretary of the society at the above address.

Meteors: C. C. Steven — For the third consecutive time the weather bureau failed to cooperate with our meteor section and permitted old man weather to hand us a flock of precipitating clouds.

Much constructive effort was made to equip the photographic, spectroscopic, and visual stations to collect data on heights, velocities, and radiants, but as the season of favorable observations is just beginning this preparation was not felt to be time lost by the some thirty members who stood by. The evening was well spent in lining up the program for the future showers and the Lyrids were finally abandoned at 1:30 due to the unfavorable aspect of the elements.

Historically, we find records of the Lyrid shower that date back some 2500 years. The early records of Chinese astronomers carry observations of this shower, possibly the first, as early as 687 B. C. (23 March). A second account of the shower found among the Chinese annals reads, "March 27, 15 B. C., after the middle of the night, stars fell like a rain; they were 10° to 20° long; this phenomenon was repeated continually. Before arriving at the earth they were extinguished." The last great shower of the Lyrids appeared in 1803, well seen in the eastern part of the United States, from North Carolina to New Hampshire.

The next shower that the society plans on observing is the Eta Aquarids, the maximum being expected from the 4th to the 6th of May. Again we are making extensive plans for observing and we hope that the weather bureau will be a little more considerate.

While heights were much in demand for the Lyrids, radiants rank first in importance for the Aquarids. It is therefore planned to add an additional man to each cooperating station established, whose time will be devoted to the plotting of meteors for the determination of radiants. The Eta Aquarids are thought to be associated with Halley's Comet and accurate radiants of the coming shower will help to further the knowledge of this interesting stream.

We note with interest an article in Science News Letter for March 24, 1934, announcing a "Planetary Merry-Go-Round" to be opened next year in connection with the American Museum of Natural History in New York City.

This "merry-go-round" will be known as a Copernican Planetarium and will supplement the Zeiss Optical Planetarium being built and with which most of us are familiar.

The visitor to the Copernican Planetarium will be carried in a small carriage in a circle, which represents the earth's orbit, around an illuminated globe at the center, representing the sun. Around and above him will move models of the earth itself and other planets, on tracks, thus giving him an opportunity to view the ever changing aspects of our solar system.

While this may be less spectacular than the Zeiss Optical Planetarium we have no doubt that the average layman who visits it will be better able to comprehend the inner workings of our solar system than he can the unimaginable distances and motions of "galaxies", "spiral nebulæ" and the like. Operated in conjuction with the Zeiss Planetarium the two will certainly afford a complete practical education in the more apparent phases of astronomy to the individual who is interested enough to make periodic visits.

The members of this society will watch with interest the progress of this and other planetariums as they are built throughout the country.

ADJUSTING THE TELESCOPE

R. D. COOKE

THE possession of a well adjusted equatorial mounting with circles is not only a great convenience for observing but is well nigh indispensable for the observer who wishes to locate faint objects or to identify unknown ones. This paper will outline briefly a method for placing such a mouunting in adjustment sufficiently close for all exacting needs.

The first group of adjustments has to do with the relations of the axes and circles to each other without regard to earth or sky and the second group to orienting the whole mounting with respect to the earth. It is assumed that the optic axis of the telescope is parallel to the tube, that the declination axis is at right angles to the polar axis, and that the circles are accurately graduated and not eccentric. The first step is to get the optic axis at right angles to the declination axis. The telescope is set up in approximate position and the tube pointed horizontally south. The declination axis is leveled with a small level placed directly on it. A stake or mark is set some distance south so as to be seen in the center of the field. From a position at this mark a second mark is sighted in to the north directly in line with the center of the telescope tube. The telescope is then turned to the new mark keeping the axis level, and this should be in the center of the field. If not, the cradle is adjusted by shimming until the second mark is brought halfway back to the center of the field and the whole process repeated.

To set the circles, the declination axis is leveled and the hour circle index adjusted to read zero. Then the polar axis is turned so that the hour circle reads six hours, the tube placed level in an east and west direction and the declination circle index set to zero. The axes and circles are now all in adjustment with respect to each other, and it remains to place the polar axis parallel with the earth's axis as nearly as possible. This is done in two steps. First, the polar axis must set in the plane of the meridian. For this select a time when Polaris is on the meridian, either above or below the Pole. Polaris and delta Cassiopeiæ have nearly the same right ascension so the latter may be used as a rough guide, but it is better to determine beforehand the exact time. At that time set the hour circle at zero and bring Polaris to the center of the field by rotating the entire base in azimuth. This should be checked quickly with the telescope on the other side of the pier.

The final adjustment is to set the polar axis at the correct altitude. There are four simple ways of doing this. (1) With the declination circle set to read the colatitude and the declination axis level the base is tilted until the tube is level. (2) With the declination circle set to read the latitude and the axis level as before tilt the base until the tube is vertical or parallel with a plumb line. (3) With the hour circle at six hours and with Polaris at eastern or western elongation tilt the base until Polaris is brought to the center of the field. (4) With the declination axis level and the circle set to the declination of a selected star near the zenith, tilt the base until the star is in the center of the field as it passes the meridian.

It is advisable to repeat the entire process as some of the adjustments may have been disturbed in making the others. This method will suffice for all requirements except photography with long exposures. There are more precise methods for refining the adjustments, but these are too exacting to be discussed in this limited space.

THE JUNIOR AUXILIARY

With the approach of warmer weather, the Juniors are familiarizing themselves with more of the constellations. This is done by holding outdoor meetings and by assisting the Seniors in observing meteor showers.

As the study of the planets is of major interest to all of the junior members the following papers will be presented at the June meeting: "The Planet Pluto" by Raymond Spores and "Saturn" by George Diedrich.

THROUGH THE EYEPIECE

J. F. LOEPFE

Predictions are in Central Standard Time corrected for this vicinity.

The Sun — Passes from the constellation Aries to the constellation Taurus later in the month. On May 21 the sun enters Gemini, the third spring sign of the Zodiac.

The Moon — Phases: Last Quarter, May 6, 12:41 A. M.; New Moon, May 13, 6:30 A. M.; First Quarter, May 21, 9:20 A. M.; Full Moon, May 28, 3:41 P. M. Perigee, May 2, 228,260 miles; apogee, May 18, 251,590 miles; perigee, May 30, 225,130 miles.

Mercury — Morning star until 11:00 P. M. May 12, when it is in superior conjunction with the sun. After this it will appear as an evening star; not well placed for observation this month.

Venus — Morning Star. In conjunction with the moon May 9, 6:19 P. M., and with Uranus June 1, 11:00 A. M. Rises about 2:00 A. M. on the 15th.

Mars — Morning star but not visible due to its proximity to the sun. In conjunction with the moon May 12.

Jupiter — Evening star in Virgo. Magnitude, May 15, is - 1.9 and transits at 9:14 P. M. It now rises before sunset. In conjunction with the moon May 12.

On May 11 the following interesting phenomena of Jupiter's satellites occur: 7:59 P. M. Sat. III, disappears in occultation; 8:45 P. M. Sat. I, transit ingress; 9:30 P. M. Sat I, shadow ingress; 10:08 Sat. III, occultation reappearance; 10:56 P. M. Sat. I, transit egress; 10:56 Sat. III, eclipse disappearance; 11:41 P. M. Sat. I, shadow egress. Sat. III reappears from the eclipse at 1:11 A. M., May 12.

The following eclipse phenomena are noted for the month: May 12, 8:49 P. M. Sat. I (R); May 19, 10:44 P. M. Sat. I (R); May 23, 8:51 P. M. Sat. II (R); May 27, 0:38 Sat. I (R); May 28, 7:07 P. M. Sat. I (R); May 30, 11:27 P. M. Sat. II (R). Low power telescopes will afford a great deal of satisfaction in observing the phenomena of Jupiter's satellites.

Saturn — Morning star in Aquarius, favorably placed for observation, rising at about 1:30 A. M. on the 15th. In conjunction with the moon May 6, 11:18 P. M.

Uranus — Morning star, too close to the sun for observation. *Neptune* — Appears as an eighth magnitude star in Leo. In conjunction with the moon May 22, 7:11 A. M. *Pluto* — Located in Gemini.

We regret that the illness of Dr. Stebbins made it impossible for him to address us at the last meeting and we extend wishes for a speedy recovery. He assures us that he will be glad to speak to us at a meeting of the society early in the Fall.

Current Astonomical Notes

M. F. WADLEIGH

Bright-Dark Stars! In "Some New Astronomical Advances", by Prof. Russell, Scien. Amer., March, are discussed, in his usual entertaining way, some recent findings regarding measurement of galaxies. Also new matter on heat radiation from variable stars; use of the thermocouple as a new method of "seeing" these stars.

Billions of Cycles; F. Zwicky; Scien. Amer., March. About this universe from the point of view of being a function of a great range of waves. A most complete and interesting table is appended giving systematic data on the full range of known waves, from alternating current to cosmic.

Shot from the Hip — and got his Fireball, head, tail, and all; Science News Letter, March 24. A stirring story from the western plains, about how a certain Mr. Brown came to take a rare photo of a visitor from the heavens.

Also more information about the aluminum mirrors in the same magazine.

The Character of Long-period Variable Stars: Sixth paper of a series, by Paul Merrill; Pop. Astro., April, and Science News Letter Jan. 12, '34.

Halley's Comet as observed by the Chinese. A series of thirty reports of observations as recorded between the Eighth century B. C. and 1896, by Mr. Wen Shion Tzu. Ibid.

Sundials Again: Second article by Mayall and Mayall; Scien. Amer., Mar. Some simple directions for accurately determining important lines and planes.

Cross-Hairs

To date the society has supported our Bulletin splendidly. The reception accorded it seems to indicate that its publication is filling a long felt need for something to bind our varied interests together. We are still somewhat in the dark as to what you, as individual members of the society, would like to have published. The secretary, or any member of the committee, will be glad to receive your comments and suggestions.

We would like to make a suggestion. With the approach of the vacation season a great many members will be unable to attend the regular meetings. We're sure that none of you will want to miss a single copy of The Bulletin. and in order to insure against any omissions may we ask you to hand in your subscription, either to the secretary or to some member of the committee, immediately. There will be a great deal of activity this summer and we know that everyone will want to be kept informed of what is happening. The best way to be sure that you will be is to subscribe now:

Another suggestion — no doubt each of you know of some person interested in astronomy who is unable to attend our meetings. Will you not let us send them a sample copy of The Bulletin so that they may see what we are doing? If you will supply the name and address we will send them a sample copy. A telephone call to ORchard 4582-M or BLuemound 7103, or, if you are outside of Milwaukee, a postal to the secretary, will take care of that and will introduce the society and our Bulletin. Thank you.

VARIABLE FIELDS

W. S. HOUSTON

ONE of the primary aims of the Milwaukee Astronomical Society is to collect data that are of value to the professional astronomer, and in the fields of meteoric and occultation astronomy the society has made contributions. In the field of variable-star astronomy, however, little has been accomplished. This is not because of any inherent dullness in variable observing; any practical observer will tell enthusiastically of the pleasures that come from watching these super-giants rise from faint magnitudes, night after night, and then slowly fade back and seem to be lost in the infinite blackness of space.

Members of the society have been working on possible methods of better introducing variable work to amateurs, and they have found that the greatest difficulty in beginning observations is the inability to locate the fields covered by the Harvard blue-prints. To remedy this situation these men have listed a number of variable stars which are close enough to some naked-eye star to be included with it on the same blue-print, and therefore close enough for both to be in the telescopic field of view at the same time. Thus anyone who can point his instrument to the stars that are shown on his naked-eye atlas can readilv locate a considerable number of variable star fields.

To locate any one of these variables, first determine from the mimeographed lists that accompany this magazine the naked-eye star that lies close to the variable; then locate this star on your atlas; then locate this star in the sky. Once set on this star, find your cardinal points by letting the stars trail across the field (east to west); this done, tilt your AAVSO "d" chart until it has the same tilt as the telescopic field. Now you are ready to locate the variable.

Begin at the bright naked-eye star and work out, identifying the brighter stars as you do so, until the variable has been reached. Of course the variable may be quite bright or perhaps invisible so the field will always appear a little different than the chart but if one is passably careful no great trouble will be experienced.

Once the variable has been seen its magnitude is to be determined. On the AAVSO "d" chart certain stars that surround the variable are marked with their magnitude to one decimal place. However the decimal point is always omitted for clarity and so 123 signifies 12.3 magnitude. By comparing the variable with these comparison stars it will always be found possible to choose two, one of which is just fainter and one of which is just brighter than the variable. The exact magnitude is then estimated by judging how close the variable is to one of them as compared to the total difference between the two stars. Now while it sounds like a difficult matter to estimate by this method to a tenth of a magniude, it is really little trouble at all and most people make very accurate estimates at their first attempts.

A few hints might well include — use a low powered ocular; in comparing two stars always keep the line joining them parallel to the line joining your two eyes, otherwise errors as great as half a magnitude result. Remember that these fields are for "d" charts, the central square of which just holds a full moon. If you chance to get "b" charts remember the scale is much different. Try the fields that are listed as very eacy on the lists before you attempt harder variables. If charts or atlases are desired see H.L. Grunwald or L. E. Armfield. Further lists of variables of increasing difficultv of location will be supplied if there is enough interest demonstrated.

Just a hint for you fellows who are constructing telescopes and grinding and polishing mirrors, in testing a mirror for focal length, by the candle test, you test at the radius of curvature, which is twice the focal length.

The MAS Bulletin

Published Monthly by the Milwaukee Astronomical Society

Vol. 1, No. 5 JUNE, 1934 Ten Cents

THE VATICAN OBSERVATORY AND FATHER HAGEN

MISS ELIZABETH WIGHT

IN THE early part of the ninth century the city of Rome and the nearby palaces of the Popes at the Vatican were plundered and nearly destroyed by hords of Saracens, who knew of the wealth of the great city and of the riches of the papal fathers. To protect the Vatican Pope Leo IV, in 848-853, built a wall around it, which was, and is, known as the Leonine Wall, containing twenty-four fortressed towers and three barricaded gates. It was forty feet in height, about thirteen feet thick, and the towers were fifty-one feet high. As the years passed and foreign invasion was no longer iminent the fortressed wall fell into decay and was gradually destroyed, except for some four hundred yards of wall and two towers which are now surrounded by the Vatican gardens.

The remaining section of wall and the towers are, however, used. Legend says that in one of the two remaining towers the men met who were assembled by Pope Gregory XIII, during the sixteenth century to reform the calendar; later it housed simple meteorological and astronomical instruments; and in the latter part of the twentieth century both towers were made into a modern astronomical observatory.

At the present time this observatory building, of such unusual origin, contains a 16″ refractor in one tower, an astrographic refractor in the other; on one end of the wall, a 4″ equatorial, and on the other a photoheliograph. Rooms inside the towers, formerly headquarters for soldiers guarding the papal safety and wealth, are now laboratories, computing rooms, and all that a modern observatory call for.

The last astronomer of prominence to act as director of this observatory was Father Johann Georg Hagen, S. J. He was born in Germany in 1847, was educated in that country and in Austria, joined the Society of Jesuits at the age of sixteen, and in 1878 was ordained a minister and sent to Campion College in Prairie du Chien, Wisconsin. He had become particularly interested in mathematics and astronomy, so at Prairie du Chien he erected a crude observatory to observe variables. Ten years later he was appointed director of the observatory of Georgetown Col- Washington, D. C., and there, having at his disposal its excellent equipment, he started making charts of variables, a work that extended through almost the rest of his life and resulted in a wonderful collection of maps called the Atlas Stellarum Variabilium. These formed the foundation for the variable star charts now in common use. In 1906 he was called to the directorship of the Vatican Observatory and he held that position until his death.

Father Hagen died in Rome at the age of eighty-three, a gentleman and scholar, whose placidity of spirit shone from his face, who was eminently proud of his observatory building of over a thousand years, and who was honored by the Pope, when he reached the age of eighty, by receiving from him a gold medal in commemoration of a lifetime of scientific achievement.

(Editor's Note—This article is from the memoirs of Miss Wight, who has had the honor of having met and talked with Father Hagen personally.)

The official monthly publication of the Milwaukee Astronomical Society, 2046 S. 59th St., Milwaukee, Wis.

Ten cents per copy, $1.00 per year. Contributions are solicited but cannot be paid for. Their publication, either in whole or in part, is solely at the discretion of the committee on publications. Address all communications to the secretary of the society at the above address.

The next regular meeting of the society will be held at the University of Wisconsin, Extension Division, Friday, July 6, at 8 P.M. No program announcement can be made at this time.

We welcome Norman Menzel, 1720 W. Clarke St., as a new member.

THE JUNIOR AUXILIARY.

A paper entitled "The Parallax of Stars" by Raymond Cooke will be one of the papers presented at the July meeting.

WORKING SECTIONS.

Variable Stars: H. L. Grunwald — This month we are reprinting a paragraph from Variable Comments, issued by the A. A. V. S. O., Leon Campbell, Recorder.

"A few months ago the idea of ------RS Ophiuchi------ as an interesting variable would not have been thought of, but the fact that L. C. Peltier, our ace observer at Delphos, Ohio, found it exceedingly bright on August 15 last, certainly makes this star of first place in our consideration.

"What greater satisfaction after twelve long years of painstaking pegging away at a star which had remained practically at the same magnitude during all that time than to find it suddenly bright, nearly of the sixth magnitude! Known and recognized as a nova-type variable for over thirty years, who but a Peltier would have had even a hunch that the star would some day rebrighten, perhaps even to a brighter magnitude than at its original outburst. Thanks to Peltier's foresight and prompt announcement, it was possible to secure at several of the world's largest observatories photographic plates showing its typical nova-type spectrum, as well as to enable us to issue charts for observational purposes."

We give you this excerpt to show you what some of the rewards of regular variable star observing are. We'll welcome more volunteers to this group.

Occultations: R. D. Cooke—Only two dark limb immersions will be seen at Milwaukee in June, and these are not favorable since they are just before the full moon and not especially well placed.

Date	Star	Mag.	Imm.	Pos. Angle	Moon's Age
June 25	95G Oph.	6.1	7:46 PM	52°	14d
June 26	43 Oph.	5.4	1:04 AM	105°	14d

CURRENT ASTRONOMICAL NOTES.

M. F. Wadleigh

Life on Other Planets: H. N. Russel. Arguments on basis of precise knowledge of conditions on planets and known principles. Scientific American, June, 1934.

A New Sun Spot Cycle Begins: Isabel Lewis. Describes the characteristics of Sun Spots. Also "Some Curiosities of the Sky", descriptive of better known variable stars, nebulae, etc. Nature, May and June, 1934.

Nunki Meets the Moon: Science News Letter, May 5. General description of the heavens for May; also more about the occultation of Sigma Sagittarius (Nunki) by the moon.

The Hayden Planetarium of the American Museum of Natural History; Clyde Fisher, Curator. A history of planetaria and orreries; descriptive inventory of contents and displays to be for this planetarium; comments by many noted scientists. Popular Astronomy, May, 1934.

We have just received a Harvard Announcement card which states that information received at Harvard on May 12 from Prof. R. G. Aitken reports a photograph taken by Dr. H. M. Jeffers showing a 19th magnitude object with proper motion similar to the 8th satellite of Jupiter. This may be a 10th satellite of this planet!

* * *

A later announcement, from the same source, states that the 19th magnitude object shown on Dr. Jeffers' photograph is almost certain to be an asteroid.

ABSTRACT
of
"LEGAL OWNERSHIP OF METEORITES"

by

H. W. Cornell

(Presented to the Milwaukee Astronomical Society, May 4, 1934)

Suppose in your walks across the country a meteorite falls from the sky and strikes the ground at your feet. If you take a stick and dig it out of the ground the question immediately arises as to just who owns the object.

Most of us would immediately think that, according to the old rule of "finders, keepers", the meteorite would belong to the one who dug it up; but it turns out that quite the contrary is the case. For the law says that a meteorite belongs to the person who owns the land upon which it falls. Such a decision was handed down by the Supreme Court of the State of Iowa in 1890 in an interesting case where the meteorite had fallen on land occupied by a tenant farmer and which had subsequently been sold by the tenant. The owner of the property brought suit and recovered the stone.

Another, similar case, came before the Supreme Court of the State of Oregon in 1905. Here there were certain extenuating circumstances which made this case different from the preceeding one. In this case it was alleged that the meteorite, which was an extremely large one, had been dug up and used by the Indians as a ceremonial stone and hence should be classed as an archaelogical relic and not strictly as a meteorite. If this contention had been upheld the stone would have belonged to the finder and not to the owner of the ground upon which it had been found. In this case, as in the preceeding one, the court ruled, however, that the meteorite belonged to the owner of the property upon which it was found.

" THE ELUSIVE METEORITE"

Our Secretary, L. E. Armfield, has turned from observing to exploring. We are told, however, that the lapse is temporary and not permanent. Mr. Armfield has recently investigated and reported falls of two meteorites in Wisconsin.

A meteorite was reported to have struck the Court House at Fond du Lac on October 14, 1911. Mr. Armfield was fortunate in being able to interview the Chief Engineer who was on duty at that time and to learn that the phenomena was actually nothing more than the falling of an iron ornament from the roof during a storm.

Another meteorite was reported to have fallen near the village of Red Granite, Wisconsin, on the evening of October 24, 1931. A fairly large stone which was recovered near the scene proved upon careful investigation to lack the necessary characteristics of meteorites. Mr. Armfield hopes to investigate this further during the coming summer.

"CROSS-HAIRS"

We are glad to learn of the organization of an astronomical society in Reedsburg. It now has nine members and Mr. P. M. Loofboro is their president. May we extend our best wishes for a continued growth and a great success in the science.

Also a note at hand telling us about tentative plans for a similar organization at Madison. No particulars available at this time but we hope to have them for the next issue of The Bulletin. Although we are still young in our organized career, may we offer our help in any way to these newly organized groups?

The American Meteor Society, Mr. Chas. P. Olivier, Pres., has granted permision to its Regional Director, L. E. Armfield, to use the MAS Bulletin as the official organ for this region. Everybody interested in meteor work will do well to watch each issue for pertinent news, as the Regional Director has some interesting plans for the future.

The committee on publications is preparing a mimeographed bulletin containing the collective experience of our members in mirror grinding. This will contain information that can be found in no other publication and will bring out a lot of details not widely known. The pre-publication price is twenty-five cents; thirty-five cents after it is out. We'll gaurantee that it will be well worth it, so get your order in.

AMERICAN METEOR SOCIETY NOTES

Wisconsin-Northern Illinois Region

With the return of the summer season, plans are under way for the establishment of a regular meteor observing program by many members of the Wisconsin-Northern Illinois Region.

Unfortunately, the moon is nearly full on the night of maximum of five of the remaining eight showers scheduled to return before the end of the year. The moon will be out of the way for only the Perseids, Draconids, and Geminids. Consequently, many members of this region are making special efforts to establish stations during the Perseid display in an effort to secure the duplicate observations so necessary for real height data.

In spite of the moon's unfavorable cooperation during the coming months, it will, nevertheless, be worthwhile for individuals to do radiant plotting during the Pons-Winnecke and Delta Aquarids, which attain their maxima on June 28 and July 28, respectively.

The eta Aquarids were well observed from the 1st to 6th of May by members of the meteor section of the Milwaukee Astronomical Society under the local leadership of Chas. C. Steven and by members of the Reedsburg Astronomical Society under the leadership of Vernie J. Niebuhr.

All observers were well compensated for their efforts by the appearance of a very brilliant fireball which traversed an arc of 120 degrees across the sky. Excellent beginning and ending points were obtained by all stations and accurate height determinations are anticipated by the completion of the reductions being made at the time this goes to press.

THROUGH THE EYEPIECE

J. F. LOEPFE

The Sun — On the 21st of June, 8:48 P. M., is at summer solstice on the tropic of Cancer. This marks the official beginning of summer. During the month the sun will pass from Taurus to Gemini.

The Moon — Phases: Last Quarter, June 4, 6:53 A. M.; New Moon, June 11, 8:11 P. M.; First Quarter, June 20, 12:37 A. M.; Full Moon, June 26, 11:08 P. M.

Mercury — Evening star. On June 14 it will be at its greatest eastern elongation and should be visible about 15 degrees above the western horizon at sunset.

Venus — Morning star in Aries. In conjunction with Uranus June 1, 11:00 A. M., and with the moon June 8, 1:38 P. M. Venus rises at 2:18 A. M. on the 15th.

Mars — Morning star appearing between Venus and the sun. In conjunction with the moon June 10, 5:11 P. M.

Vesta — the brightest asteroid. Located in Leo — R. A., June 12, $11^h\ 59^m$; declination, 9° 10′ N.

Jupiter — Evening star in Virgo. Its retograde motion ceases June 10. In conjuction with the moon June 21, 10:05 A. M. Jupiter sets at 12:57 A. M. on the 15th.

Saturn — Morning star in Aquarius, rising at 11:15 P. M. on the 15th. Magnitude, +1.0. In conjuction with the moon June 3, 6:43 A. M., and June 30, 1:48 P. M., being about three degrees south of the moon at both times. *Uranus* — Located in Aries. *Neptune* — June 15 — R. A. $10^h\ 47^m$, declination 8° 44′ N. *Pluto* — Located in Gemini.