The MAS Bulletin

Published Monthly by the Milwaukee Astronomical Society

Vol. 1, No. 6 JULY, 1934 Ten Cents

ABSTRACT

"The Drama of the Bursting Star" by Dr. Edwin B. Frost

(*Presented to the Milwaukee Astronomical Society, June* 1, 1934)

A star "blows up", a catastrophy far transcending anything on this earth. Even the eruptions on the edge of the sun are as nothing compared to a star's sudden increase in brightness from twenty thousand to forty thousand fold within a few hours or days. Cataclysmic as these phenomena appear they are orderly and according to law.

Dr. Frost mentioned historical novae which have appeared through the ages. The nova of 1891 was the first to have its spectrum photographed and many new facts were learned and theories developed in attempting to account for novae. Since 1901 four brilliant novae have appeared and have been studied in great detail, their spectroscopic phenomena being similar in many respects. In the past fifteen years there have been over one hundred found in the Nebula of Andromeda alone and at least ten per anum are estimated to occur in our own galaxy.

In 1918 Nova Aquila, which was the brightest of all, attained in a few hours forty thousand times its original brightness. The change from star spectrum to nebular spectrum took place after a few months but bright lines began about the second day.

The origin of our solar system has heretofore been based purely on mathematical deductions. Some astronomers believe in the possibility of two stars passing so close together that gravitation caused a cigar shaped mass of gas to be pulled away from one, which eventually disintegrated into planets. In Dr. Frost's opinion, theories should not be based on pure mathematical deductions, but upon the observations of nature. In this respect, with observational evidence available which was largely derived through the study of novae, he showed that the formation of planets could be due to a sequence of natural laws rather than to a chance encounter between two stars, as deduced by Jeans and others. As a further illustration of this series of natural events, it is shown that some stars rotate with an excessively high rim velocity and when they explode the rotation of the star is of course imparted to the gas which is thrown off by the explosion and eventually molds itself into a rotating ring, which, in turn, may form into planets. A ring of gas around Nova Aquila has actually been under observation in the greatest telescopes since 1918 and is seen to be increasing its diameter each year with a daily increase of 100 million miles.

If planets are thus formed, millions of stars which have gone through an explosion in the natural stage in their evolution may have planets about them with a possibility of life thereon.

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, August 3, at 8 P. M. The meeting will include a paper by J. C. Meyer entitled "Guiding of Telescopes".

THE JUNIOR AUXILIARY.

The August meeting, August 3, at 7 P. M., will include a paper on "The Sun" by F. J. Volzgen. The meeting will be held in a separate room, which will eliminate the unavoidable disturbances heretofore experienced.

WORKING SECTIONS.

Variable Stars: H. L. Grunwald—The membership in this section has been considerably increased during the past month and now numbers eight active observers. Those who reported observations for May are: Armfield, Boyd, Dieter, Grunwald, Halbach, Houston, Loepfe, and Peck.

A number of conspicuous variations are taking place at the present time and through the observations of our members and the published bulletin of the AAVSO we are able to make the following comments and predictions: SS Cygni—Maximum No. 272 occured in March and proved to be of the peculiar D-1 type; No. 273, of the broad A type, occured on May 20, and No. 274 is predicted for July 26 or near that date. Close watch should be kept of this star to catch the expected rise. U Herculis—At maximum this spring, the star has gradually decreased in brightness during May and June and will remain between 8th and 10th magnitude during July. W Herculis—Since the early part of May, when this variable was less than 13th magnitude, a steady rise has taken place and will continue until a maximum is reached during July. The star is now between 10th and 12th magnitude.

Special watch should be kept over all novae type variables as sensational outbursts, such as experienced in Nova RS Ophiuchi last summer, are apt to occur at any time.

Even though it may be a disheartening task, the star R Coronae Borealis should remain under careful observation. The star has now remained at approximately the same magnitude for a long period of years. A sudden flareup, possibly of short duration, can be detected only through continued observation.

Occultation: R. D. Cooke—The following occultations will be visible at Milwaukee and vicinity during the July lunation:

Date	Star	Mag.	Imm.	Pos. Angle	Moon's Age
19	87 Virginis	5.8	8:13 PM	175°	8 days
23	X Sagitt	4.4	6:58 PM	55°	12 days
23	10G Sagitt	5.7	11:36 PM	130°	12 days
24	sigma Sagitt	2.1	7:19 PM	74°	13 days
25	336B Sagitt	6.5	8:42 PM	73°	14 days

The occultation of sigma Sagittarii on July 24 will be of unusual interest as it is the brightest star that will be occulted this year. It will be worth waching even with a small telescope, but the occurrence will be such a short time after moonrise that it will require a good clear view low in the southeastern horizon.

Compilation of occultations observed in 1932, just published, shows that of 135 observations made in the United States (not including those made at the Naval Observatory) only seven were made away from the Atlantic States—five at Portland, Ore., and two at Denver. This shows the opportunity we have for filling a gap in the chain of observing stations. We are eager to have more members with telescopes profess an interest in this line of work.

Meteors: C. C. Steven—Local meteor section notes will be found under AMS Notes; Wisconsin-Northern Illinois Region.

SUN-SPOTS AND RADIO RECEPTION

G. A. Parkinson

Astronomers have known for over a century that there is a correspondence between magnetic changes in the earth and changes in solar radiation due to sun-spots. It is only during the past ten years however that they have come to understand the close relationship between sun-spot activity and radio reception.

Before considering in detail the results of the investigations it may be well to review briefly some of the known facts regarding the transmission of radio waves in the earth's atmosphere.

When a radio impulse leaves the transmitting station, instead of being propagated out into space in a straight line, it encounters a conducting layer in the upper regions of the earth's atmosphere and is reflected by this conducting layer back to the surface of the earth. This layer which consists of rare atmosphere in a high state of ionization is called the Kennelly-Heaviside layer and consists of two bands which affect radio reception. The lower or "E" layer reflects frequencies up to 3000 kilocycles per second at an average altitude of about 65 miles during daylight hours. Higher frequencies, from 4000 to 5000 kilocycles per second show a similar response to a band called the "F" layer ranging from 120 to 180 miles in height.

While the exact way in which these layers turn back the radio waves is not known, it is known that any change in the intensity or degree of ionization of these bands changes the angle of reflection of the wave and this results in a change in the resulting intensity of radio reception recorded at a given distance from the broadcasting station.

In correlating the variations in the intensity of radio reception and sun-spot activity observers have used the Wolf number for the intensity of sun-spot activity. This number was first used by Wolf of Zurich and subsequently by his successors Wolfe and Brunmer and is given by the formula

$$N = k(10g + f)$$

N is the Wolf number, k is a constant depending upon the observer and the instrument, g the number of sun-spot groups, and f the total number of spots both isolated and in groups.

The method of procedure in this problem has been to make quantitative measurements of the fluctuations in the intensity of radio reception at a given observatory and to correlate these fluctuations with the fluctuations of the Wolf numbers over the same period of time.

During the past few years measurements of radio intensity have been made at the Harvard Laboratory, Perkins Observatory, and at Pasadena. In addition to this a cooperating schedule for photographing the sun every day was worked out by the Harvard, Perkins, Yerkes, Mount Wilson, and Naval Observatories.

These investigations have been supplemented by the work of the late Professor Austin and his colleagues at the U. S. Bureau of Standards.

All of these investigations show a high correlation between decreases in radio intensity and increases in sun-spot activity. Even minor variations in one show corresponding variations in the other. In addition to this G. W. Pickard has shown by a series of investigations that night static is increasingly bothersome when sun-spots are more numerous. In fact, Mr. Pickard has shown that the rotation of the sun when spots are visible has a very noticeable effect upon static.

All of this bodes ill for radio listeners since the present sun-spot cycle is just beginning and will not reach its maximum for about five years.

CURRENT ASTRONOMICAL NOTES

M. F. Wadleigh

The Great Meteor of March, 1933: Ninninger (Sec. of Soc. for Research on Meteorites). A detailed discussion based on thorough research for data. The method of research for data by Mr. Ninninger should be studied by all interested in this field. Pop. Astro., June-July.

The Japanese Eclipse Expedition to Losap: J. J. Johnson. The expedition made by the Japanese for the purpose of studying the February eclipse. Pop. Astro., June-July.

Exploring the Milky Way: Isabel Lewis. A general description. The editor appends a note asking for advice from interested readers as to how this monthly article might be varied. Here is an opportunity to bring out some interests of the amateur. Tell the Editor. Nature Magazine, July.

Fading Beliefs in Life on Other Planets: Henry Russell. How accumulating of data, as methods are improving and new means of ascertaining data are developed, is leading us to abandon hope for life, as we know it on the earth, on the other planets. Scientific American, June.

AMERICAN METEOR SOCIETY NOTES

Wisconsin-Northern Illinois Region

L. E. ARMFIELD

Grateful acknowledgement is hereby given to the members of the meteor sections of the Milwaukee and Reedsburg Astronomical Societies for their excellent efforts and cooperation during the six nights of the Aquarid meteor shower activity. At least two members were on duty each clear night of the period May 1 to 6. Cooperative stations were established at Port Washington, Kenosha, Watertown, and Milwaukee by the Milwaukee society. The Reedsburg group under the excellent leadership of Vernie J. Niebuhr established a station on the roof of the local High School and secured height data in cooperation with the Milwaukee Station. A summarizing report of the observation made is given below:

Station Observer	1934 May	Minutes Observed	Meteors Observed Aquarids	 Sporadics	 Total
Milwaukee §§					
A. L. Peck *	1-2	210	2		2
	3-4	60		2	2
	5-6	230	2	5	7
Theo. Thompson **	1-2	210			2
	2-3	180			10
Mrs. L. E. Armfield *	2-3	180	3	12	15
M. M. Feinsilber **	2-3	180	4	8	12
C. P. Frister *	2-3	180	2	8	10
	5-6	180	3		3
	6-7	75	1	2	3
J. F. Leopfe *	5-6	180	3		3
L. E. Armfield *	3-4	120		1	1
Kenosha §					
E. H. Bruce **	5-6	180			17
J. C. Gamroth *	5-6	180	3	11	14
Port Washington §					
E. Arndt **	5-6	180			6
C. C. Steven *	5-6	180	4	6	10
Watertown Total §	5-6	210	4	25	29
Reedsburg §§					
V. J. Niebuhr *	2-3	165	1?	1	2
	4-5	60		5	5
	5-6	165	7 (2?)	9	16
Milwaukee Photo:					
E. A. Halbach	5-6	180	No photo of trails obtained		
L. H. Matthias	5-6	150	No photo of trails obtained		
Milwaukee Telescopic:					
L. E. Armfield	5-6	150	No telescopic meteors seen		
Totals		4595	39 (3?)	95	169

Recorders and timers at the various stations were as follows: Milwaukee—Mrs. L. E. Armfield, Mr. and Mrs. Wm. Liebscher, H. L. Grunwald, Theo. Thompson; Kenosha—Mrs. L. Stauber, A. G. Esche Port Washington—E. A. Brugger; Reedsburg—P. M. Loofboro. J. B. Vinson; Watertown—Miss E. Wight, H. Gaebler, M. M. Feinsilber, A. F. Boyd.

* Plotter, ** Counter, §, §§ Cooperating stations.

The MAS Bulletin

Published Monthly by the Milwaukee Astronomical Society

Vol. 1, No. 7 AUGUST, 1934 Ten Cents

THE PERSEIDS

DR. C. P. OLIVIER

(Pres. American Meteor Society, Flower Observatory, Upper Darby, Pa.)

EVERY August our Earth passes through a stream of meteors which may be counted on to give the most regular annual display. Apparently no year goes by without the Perseids coming in considerable numbers and, while of course we could hardly expect exactly the same hourly rate year by year, still the average is better than for any other annual shower. This being the case, and with the added advantage of their appearing in warm weather, more people observe these meteors than any others, and each year the files of the American Meteor Society are enriched by many thousands of observations of the Perseids. These are made in all parts of the country both by our regular members and their helpers as well as by larger numbers of persons casually interested, who may not observe again until the next August comes.

In 1934 we are particularly fortunate in having the Moon out of our way at the time of maximum which usually occurs on the night of August 11-12. On this night about 70 meteors per hour may be seen by an observer with good eyes and having a perfectly clear and unobstructed sky. If one lives in a city, the numbers are far less. Even if in the country, local haze or smoke will greatly cut down the total number seen. Therefore to observe these or any other meteors to advantage, care should be exercised in selecting the place for observation. As a last word, nothing but illness or the greatest necessity can excuse one who observes from a window. It is a hopelessly poor position and the individual so situated dooms himself to missing a large percent of the meteors which would have been perfectly visible had he chosen a proper place outdoors. Again all should be warned that periods of watching which are less than an hour long are generally wholly useless; for showers like the Perseids one should be ready to observe certainly three hours on a stretch, preferably starting not before 11 P. M., as the numbers increase steadily up to 15 hours (i. e. 3 A. M.)

Work on a shower for those without instrumental equipment but with the AMS outfit of maps, blanks, etc., may be carried on in several ways. If a large party is available, the less experienced may count the half-hour totals, trying to keep the Perseids separate from the stragglers, but recording the number of each class. Such observers should face specified and different directions. The more experienced should plot all meteors they can, noting also the time. class, and magnitude of those not seen well enough to plot, on the record sheet. If there is another station within 20-100 miles, working in cooperation, every effort should be made that each group face in such a way that the same meteors will be seen from each station. If this is done, and the plotting is acurate, there is a certainty of many good heights which can be derived from the data. Good timing at every station is almost as necessary as good plotting.

We have especially urged our regional groups to undertake this latter work. It was carried out with excellent success by several in November, 1933, the members of the Milwaukee Astronomical Society, under the able leadership of L. E. Armfield, having made a most substantial contribution. When it is remembered that ten years ago all astronomical literature did not, so far as the writer knows, contain even approximately accurate heights of more than one or two thousand meteors of all kinds and classes, the large contributions of new data *(Continued on page 36)*

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 meeting of the society will be the annual meeting. Election of officers will take place at this time as well as the regular annual business of the society. Cards will be mailed to all the members advising them as to the date and place.

THE JUNIOR AUXILIARY.

Members of the Junior Auxiliary have been doing some actual work in plotting meteors independently and it is hoped that they will take an active part during the coming shower. All members should familiarize themselves with all of the summer constellations for this work. In the near future H. L. Grunwald will give us a talk dealing with variable stars.

WORKING SECTIONS.

Variable Stars: H. L. Grunwald—A successful climax to the attempt to organize this group during the past season may be seen in the unusual amount of activity during the last two months. The total number of observations for June were 478. Those reporting and their number of observations are as follows: Armfield 261. Grunwald 55. Halbach 25, Houston 31, Loepfe 13, and Peck 93.

The group is interested in establishing the record for reporting the largest number of observations from any individual territory and have set a goal of 700 observations for July. Just as we go to press we learn that this number has already been reached and there are several days to go before the end of the month. Of course these is no object in volume if accuracy is forfeited, but a review of the acknowledgement cards leads us to be proud of our record.

Plenty of telescopes are at hand and we again urge the society members to become actively interested in some branch of observing.

Occultations: R. D. Cooke—Only one occultation will be visible in August. The circumstances are these:

Date	Star	Mag.	Imm.	Pos. Angle	Moon's Age
8/19	43 Ophi	5.4	7:59 P.M.	93°	8.5 days

Meteors: E. A. Halbach—A program of continuous observations for meteors has been inaugurated with a three-fold purpose; determining radiant points of minor showers, hourly rates of appearance, and providing instructions and practice in meteor plotting for all interested, both new and semi-experienced members. It is hoped that, by this program, more of our inexperienced observers will qualify for plotters during the coming major displays. In the absence of C. C. Steven the continuous program is being directed by E. A. Halbach and anyone interested should get in touch with him. Here is your opportunity for some actual work in practical astronomy.

From a report of the Missouri-Southern Illinois Observers we learn that during the Delta Aquarid shower three times as many meteors were visible 12 miles from St. Louis as in the city, while at a distance of 35 miles four times as many were seen per hour. At the same time at Mount Wilson, elevation 5,900 feet, only a slight increase was noted over the hourly rate at the 35 mile distance. This comaprison shows definitely the value of observing away from the city, even from the suburbs.

A program for the Perseid shower, Aug. 9-12, is being planned and details will be announced at the regular meeting. Both old and new observers are requested to turn out.

THROUGH THE EYEPIECE

J. F. Loepfe

Predictions are in Central Standard Time corrected for this vicinity.

The Sun—Passes from Leo to Virgo later in the month. On the 10th there will be an annular eclipse visible to southern Africa.

The Moon—Phases: Last Quarter, Aug. 2, 12:27 A.M.; New Moon, Aug. 10, 2:46 A.M.; First Quarter, Aug. 17, 1:40 P.M.; Full Moon, Aug. 24. 1:37 P.M.; Last Quarter, Aug. 31, 1:40 P.M. Apogee Aug. 8; Perigee Aug. 23.

Mercury—Morning star until Aug. 26 when it will be in superior conjuction with the sun. After this it will be an evening star, too near the sun for observation.

Venus—Morning star in Gemini and affords a beautiful sight in the morning twilight.

Mars—Morning star slowly moving away from the sun. **Jupiter**—Evening star in Virgo.

Saturn—Located in Capricornus. Evening star Aug. 18. The rings show up nicely with a telescope of low power.

VARIATIONS IN LATITUDE

G. A. Parkinson

According to our most common definition the latitude of a point on the surface of the earth is its angular distance north or south of the equator, measured along the arc of the meridian through the point. Using this definition it is perfectly obvious that if the earth were a rigid body it would be impossible to have a variation of latitude of any point on the surface of the earth.

If we consider latitude, however, from an astronomical standpoint, an entirely different picture presents itself. Astronomically, latitude may be and is frequently defined as the declination of the zenith. In other words, if at any point on the earth's surface we erect a perpendicular and extend this perpendicular to the point where it intersects the celestial sphere, the declination of this point is equal to the latitude of the observer.

We now see that as the earth spins on its axis, if the point of intersection of the axis of rotation with the celestial sphere (which we call the celestial pole) should move with respect to the fixed stars, this would immediately result in a corresponding variation of latitude for all points on the surface of the earth.

This variation of latitude which was first discovered independently by Chandler in Cambridge, Massachusetts, and Kuestner in Berlin, has been studied carefully and the magnitude and the period of the variation have been quite accurately determined. This "Polbewegung", as the Germans call it, has been found to have a period of 428 days and amounts to somewhat less than .6 of a second of arc. This does not seem to be a very large variation, but when we consider that latitudes can be measured with the zenith telescope by the Talcott method to about 1/100 of a second of arc, we see that .6 of a second is quite an appreciable variation.

In addition to these variations certain fluctuations in the value of latitude entirely too large to be attributed to errors of observation have been studied for a number of years. During these years all hypotheses which might reasonably explain these variations have been exhausted except one, and that is that these variations which are correlatable with the moon's changing position are due to the actual displacement north and south along the surface of the earth of the latitude station. Due to the effects of lunar tides in the surface of the earth, the maximum amount of this variation is about 1/10 of a second of arc and amounts to a displacement of the latitude station in a north and south direction of about 10 feet.

CURRENT ASTRONOMICAL NOTES

M. F. Wadleigh

Mysteries of the Solar Corona: H. W. Russell. Briefly reviewing the conquest of the spectral factors of the Corona, and intimately discussing the possibilities of interpretation of the "one remaining mystery—the bright lines of the solar corona." Here, electronic and vacuum chemistry receive important consideration. Scientific Amer., Aug.

Contribution to the Photo-electric Guidance of Telescopes: J. F. Barkelew. This appears in the amateur astronomical section. Ibid.

The Planets and their Atmospheres: Dr. W. S. Adams, Director, Mt. Wilson Observatory. Very well illuustrated. Scien. Mon.

Making the Glass Disk for the 200 inch Reflecting Telescope: Dr. G. V. McCauley. Finely illustrated. Ibid.

Siderostat Telescope: An electrical control of reflector outside building so that operator sits in comfort in a heated room to make all observations. Ready to be installed in the private observatory of S. Wynne Cook, banker, amateur astronomer in Philadelphia. This is the first of its kind at least in the United States. Science, July 13 (Supl. Page 7).

Development of Magnification: W .W. Ford. Mr. Ford is connected with John Hopkins. Science, June 29.

Outlines of Papers read before American Association for Advancement of Science, at Berkeley. Science, June 29. Also Science Service.

Some Facts about the Moon: Isabel M. Lewis. Nature, Aug.

At this time we wish to call your attention to a new book that is well worth reading. Earth, Radio and the Stars by H. T. Stetson. Written "to suggest a more intimate relationship between man and his cosmic environment."

The mammoth meteorite found in southwest Africa in 1921, although never entirely exhumed, has been estimated by Luyten to weigh between 50 and 60 tons. Its exposed surface measures roughly eight by nine feet.

Polaris travels, with its invisible companion, through an orbit as great or greater than that of Saturn around our Sun.

(Continued from page 33) on heights, secured by the American Meteor Society in recent years, will appear all the more valuable. But even yet the field is barely touched; it will take years of patient effort, here and abroad, before we know anything but rough averages. So let each person who cooperates understand that contributions of real worth are being made, provided of course that the observations are of a high degree of excellence. This last much-to-be desired ideal can only be reached by hard work and considerable practice. For while some undoubtedly attain accuracy faster than others, nobody does without real effort and patient work. Meteor observers are definitely made, though the inclination to become one may be inborn.

The photography of meteors is yet in such an uncertain state of success that only general remarks can be made here. The faster the lens, the larger its aperture, and the faster the plate used, so much the greater the chances for success. Accurate timing of any bright meteor which passes over the field covered by the lens is essential. Also, if the camera is not driven by clockwork, accurate records of when the plate was exposed and covered are necessary. Persons with proper cameras are urged to try their luck. But it is a matter of luck as to whether they will be successful or not; meteors do not usually choose the part of the sky covered by a single lens. As a matter of experience, the best chance is to center the lens about 10° above the radiant. If a stationary camera is used somewhat higher when starting the average for the exposure will be about 10°.

The Perseids are supposed to start by about July 20, and are quite numerous after August 1. Good numbers are seen on Aug. 10-11 and 12-13, as well as on the night of maximum. They end rather abruptly less than a week after maximum.

It is the writer's hope to organize several stations within 100 miles of Flower Observatory for a cooperative program covering August 10-13. The writer also strongly advises other regional directors to do the same, for, as said, the absence of moonlight makes this a favorable year. It is about needless to add that any fireballs seen during the course of observation should be carefully observed, most of all if a long-enduring train is left. This latter should be carefully observed and drawn on the map at intervals of one minute, everything else being dropped in its favor.

AMERICAN METEOR SOCIETY NOTES

Wisconsin-Northern Illinois Region

L. E. ARMFIELD

Bad weather prevailed at all stations reporting after the dates scheduled for the possible return of the Pons-Winnecke meteor stream. J. R. Vinson and Vida J. Niebuhr of the Reedsburg Astronomical Society had cloudy weather while A. Deutsch of Chicago, turned in plots for a total of nine meteors for the nights of June 27-28 and 28-29. Two of the nine appear to be a part of the stream in question. A bright moon plus a hazy sky rendered stars fainter than third magnitude invisible. Mr. Deutsch's perserverence in spite of the miserable observing conditions experienced is certainly commendable.

A milky sky greeted the following members of the Milwaukee Astronomical Society's Meteor Section: L. E. Armfield, Mrs. L. E. Armfield, M. M. Feinsilber, C. P. Frister, and L. Peck, and Theo. Thompson. A total of eight meteors were plotted, none of which could be assigned to the Pons-Winnecke stream. The regional director wishes to extend his grateful appreciation to all participating members for their loyal devotion to the observing schedule in spite of the conditions encountered.

The M A S Bulletin

Published Monthly by the Milwaukee Astronomical Society

Vol. 1, No. 8 | SEPTEMBER, 1934 | Ten Cents

OUR SOCIETY

During the past year our society has seen many things accomplished, among them being the establishment of denfiite observing programs by the technical groups with their resultant contributions to the advancement of the science, and the attainment of a great many objectives of the group interested in public education along astronomical lines.

The Variable Star, Occultation and Meteor Sections have had a very active year, as evidenced by their monthly reports in our Bulletin. Much photographic work has been done and the results submitted to the Harvard College Observatory. Public and group lectures conducted by members of the society on astronomical subjects have drawn large attendances and the start of the school season finds both the University of Wisconsin - Extension Division and Marquette University offering courses in astronomy. Both institutions will have observing facilities available for the use of their classes. The society's agitation for a public observatory and the resultant civic response have aided greatly in making the people of Milwaukee and vicinity astronomically minded. Altogether it has been a full year and much has been accomplished.

The beginning of a new year, our third as a society, finds much to be done, however. We still have a lot of room for growth in our observing sections; photographic work should attract additional members; and we still have to realize our objective of seeing astronomical courses, as such, in our high schools. A great deal of pressure must be exerted toward the realization of the public observatory objective. Public lectures must be maintained at their present high standard and a definite program for the growth of the society itself must be developed and energetically worked out.

The plans for our own observatory have advanced rapidly; splendid work by our committee in preparing sketches and blue prints has been done and this work must be continued and advanced.

The society's regular meeting programs have been of such excellence during the past year that a large attendance has been maintained throughout. New programs must be planned and carried out in such a way as to attract a large, regular attendance of interested persons from whom we may constantly draw new material for membership.

All in all, the tasks we face in the year ahead are not light and yet we are confident that they will be met successfully. There is such wealth of inherent ability along so many diversified lines among the members of our society that we need have no fears for the ultimate success of our program.

To those of our friends who may have hesitated, for one reason or another, to actively join with us in our work may we say that there is always some part of our activities that we know you will enjoy and in which you may share, regardless of the extent of your astronomical knowledge—be it large or small.

Let us go into the new year with the definite knowledge that there is much to be accomplished and that by cooperating with each other to the fullest extent of our ability we will make the name of the society one which will mean much wherever it may be mentioned.

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.

A new policy with respect to the distribution of the bulletins will take effect with the October issue. Hereafter, copies will be mailed to all members at the time each announcement card is sent. At all meetings additional copies will be available at the regular price for those who wish extra ones and for those attending and who are not members.

THE JUNIOR AUXILIARY.

Annual elections will be held at the October meeting and all Junior members are urged to be present.

WORKING SECTIONS.

Variable Stars: H. L. Grunwald— The goal set last month for 700 observations was easily passed, and the group turned in a total of 1232. The observations made during July are as follows: Armfield, 465; Mrs. Armfield, 110; Boyd, 2; Frister, 30; Grunwald, 117; Halbach, 131; Houston, 76; Loepfe, 45; Peck, 250; Miss Thurow, 6.

Occultations: R. D. Cooke—The following occultations have been predicted for Milwaukee and vicinity during the September lunation:

Date	Star	Mag.	Imm.	Pos. Angle	Moon's Age
14	pi Scorp	3.0	5:28 P.M.	47	5 d
17	psi Sagitt	4.8	10:45 P.M.	126	8 d
19	theta Capr	4.2	5:23 P.M.	56	10 d
21	150B Aquar	6.0	2:19 A.M.	80	12.5

Short wave radio equipmenet capable of receiving time signals from NAA at Arlington has been installed by R. D. Cooke and the time can be transmitted by telephone to other observers who have no other means of getting it. This can be done with sufficient accuracy for occultation work. All are invited to take advantage of this.

It may be of interest at this time to tell something of the work of the Occultations Section. We have volunteered to do computing under the direction of Professors Brown and Brouwer of Yale University, who collect and compile occultation data from all parts of the world. Many observatories do not reduce their observations of occultations, and this phase of the work is handled by volunteers, mainly members of the A. A. V. S. O. E. A. Halbach and M. M. Feinsilber have been assisting in this work. In addition to all the observations made here by members of the society we have handled the reductions of twelve observations from the Naval Observatory at Washington and sixteen from scattered observatories, including Duesseldorf, Konigsberg, Warsaw, Geneva-Switzerland, Los Angeles, and Portland, Ore. Other members who care to do so are invited to take part in this work.

Meteors, E. A. Halbach—Although our arch enemy, the moon, was not present to hinder observation of the Perseids, the weather bureau trotted forth its best and most varied selection of clouds for our benefit. Both Friday and Saturday nights, the 10th and 11th, were too overcast to permit any consistent work, although a preliminary report for those nights shows that the highest individual count for Friday night was 164 with 48 meteors in 45 minutes being counted by one observer. Sunday morning, the 12th. from 1:25 A.M. to 1:55 A.M., 49 meteors were counted by one observer. This was the only period in which the sky was clear enough to permit any work to be done. Sunday night, the 12-13th, was clear, however, and a total of 289 meteors were counted and 117 paths plotted. Two members obtained a total of 16 telescopic meteors. Detailed reports of all observations will be contained in the October and November issues. A fine turnout was experienced on all nights of the shower, the cloudy weather apparenty failing to dampen the enthusiasm of the members.

GUIDING OF TELESCOPES

J. C. Meyer

The guiding of telescopes in all but the larger instruments is confined to moving the telescope in Right Ascension to compensate for the rotation of the earth. The purpose of guiding is, in all cases, to keep the celestial body under observation confined to the field of view, and in the photographic arrangements, to keep the objective precisely lined up on some object in the field which is being photographed.

The power which is used for guiding is obtained from several different types of motors, among them being the spring or weight driven clock mechanisms and the electric motor.

The spring or weight driven clock mechanisms with their friction governors for speed control are rather obsolete, but will serve for visual work. The electric motor, in its various forms, has replaced the spring and weight clock due primarily to its reliability and ease of control.

The first type of electric motor drive to find extensive use is the Garrish drive. This is primarily a motor which is controlled by means of a relay in step with a clock pendulum and which has a fly-wheel on its shaft to smooth out the impulses created by turning the motor on and off by the relay.

With the modern electric generating stations where the frequency is very accurately controlled we find a source of energy which is very suitable for the purpose of guiding a telescope. This lies in the use of the synchronous motor as a driving source; the chief restriction to this method being the impossibility of correcting for atmospheric refraction without the use of an additional motor. This difficulty is overcome in the larger instruments by means of differential gearing and a reversible motor which is geared to the regular drive.

To compensate for the various rates of motion of planets and other celestial bodies other than the stars it becomes necessary to increase the speed of the driving mechanism either by adding to the speed of the motor with an additional motor, as stated above, or by means of a motor with a vacum tube control which serves to keep the motor speed within close limits.

The choice of driving mechanism for an instrument should be made very carefully but one's final choice should be tempered by the gearing which will be required with each method. The most perfect gearing is the worm and worm gear, while the bevel gear is considered outside the pale for serious consideration for accurate work.

(Several members of the society have had some experience on driving mechanisms and will be glad to pass on what information and experience they may have.)

"CROSS-HAIRS"

Mr. Armfield is in receipt of the 13" Cassegrainian mirror which is being loaned to him by the A. A. V. S. O. Its aluminized surface is perfect and how nice it is to be able to remove finger marks and dust without having to worry about losing the surface! The society can well be proud to have as its Secretary a member whose observational work is such that it is recognized in this manner. While we can hardly expect Mr. Armfield to increase the number of his monthly observations we can rest assured that the fainter variables will receive more attention than heretofore.

THROUGH THE EYEPIECE.

J. F. Loepfe

The Sun— Crosses the equator Sept. 23 at 11:46 A.M. It will be in Virgo this month.
The Moon— Phases: New Moon, Sept. 8, 6:20 P.M.; First Quarter, Sept. 16, 6:26 A.M.; Full Moon, Sept. 22, 10:19 P.M.; Last Quarter, Sept. 30, 6:29 A.M.
Mercury—Evening star, poorly placed for observation this month.
Venus— Morning star in Leo.
Mars— Morning star in Cancer. **Jupiter—** Evening star in Virgo. Due to its nearness to the sun toward the end of the month Jupiter will be rather difficult to observe. **Saturn—** Evening star in Capricornus. Favorably placed for observation. In conjunction with the moon Sept. 20.

OUR LIBRARY.

Do you know of the society's Library? That it has a great fund of information of subjects, both technical and popular? That it is open at all times to all members?

With the gift of many books and periodicals by the Godfrey Club of Watertown, Wisc. cataloguing was begun. There is now a complete cross index file of nearly all books and periodicals and any subject may be located through the card index with a minimnm of effort.

The library is located at the home of our president, E. A. de la Ruelle, 1426 N. Prospect Ave., and is open at all times. Mr. de la Ruelle, or any member of his household will gladly show it to you. Withdrawal of books and periodicals is governed by regular library rules which are posted for your convenience.

AMERICAN METEOR SOCIETY NOTES

Wisconsin-Northern Illinois Region

L. E. ARMFIELD

We are taking this opportunity to inform our readers of the history and activities of the American Meteor Society.

This society was founded by Dr. Charles P. Olivier and its headquarters were located at the Leander McCormick Observatory, University of Virginia, from 1914 to 1928. In September 1928 it was transferred to the Flower Observatory of the University of Pennsylvania at Upper Darby, Pa. All of the records are in the hands of Dr. Olivier, who is president, and all observations are submitted to him directly, or through the various regional directors.

The purposes of the society are as follows: (1) to encourage the careful observation of meteors and their theoretical study, (2) to encourage general interest in astronomy, (3) to have observations and reductions so made that the results shall have uniformity and accuracy, and hence be of higher scientific value, (4) to encourage experiments in visual, photographic, and theoretical meteoric astronomy, (5) to collect and file records which would otherwise be lost, (6) to see that each contributing member has the personal aid and encouragement needed and particularly that he receives the fullest credit for his contributions to the published work, (7) to promote the association of persons mutually interested in meteors, and (8) eventually to hold annual meetings perhaps in connection with some other astronomical organization.

Active membership is open to those over eighteen years old The dues are one dollar per year payable January 1st and must be accompanied by a written application for membership.

To further the aims of the Society, the members are asked to aid as follows: (1) to observe for more hours, even if less frequently and to be careful to follow instructions, as deviations cause useless trouble and confusion when reductions are made, (2) to send in reports promptly, (3) to interest others in the work, and if they live near other members, to get in personal touch with them, this being a great mutual incentive to better work, (4) if a great fireball is seen or a meteorite falls in their state, to make immediate efforts to secure reliable data from as many persons and places as possible, (5) to keep a record of the dates and magnitudes of all telescopic meteors seen by them. Members of the A. A. V. S. O. are particularly requested to send in reports of telescopic meteors. The time required for such records is negligible and if they are sent in at the end of each year the sum total will eventually be most useful for statistical studies. On request, standard forms for telescopic meteros will be furnished to any observer.

Those who wish more than a superficial knowledge of meteoric astronomy will do well to study Dr. Olivier's book, "Meteors" published by Williams and Wilkins Co., Baltimore, Md.

If any of our readers are interested in becoming members of the AMS, or know someone who is, they may write to L. E. Armfield, 2046 S. 59th St., Milwaukee, Wis., or to Dr. Chas. P. Olivier, Flower Astronomical Observatory, Upper Darby, Penna. All publications of the society (AMS) are issued gratis to members.

The M A S Bulletin

Published Monthly by the Milwaukee Astronomical Society

Vol. 1, No. 9 | October, 1934 | Ten Cents

THE HARVARD THIRTEEN INCH REFLECTOR

L. E. Armfield

Early in February of this year, Prof. Leon Campbell, Pickering Memorial Astronomer of the American Association of Variable Star Observers, wrote ne to the effect that the association had a thirteen inch disk of glass which it would have made into a mirror and loan to me for variable star research. The offer was made on the basis that the optical system, consisting of the primary and secondary mirrors, would be furnished by the Association and that I would provide the mounting. Needless to say the offer was accepted and by the latter part of February the glass was in the optician's hands for grinding, after which it was forwarded to Cornell University, where it was aluminized.

The detailed plans for the mounting rapidly took form on the drafting board under the skillful hands of Arthur Fotsch. From these plans a most excellent mounting was constructed by Charles Fischer, whose high precision work cannot be to strongly commended. It is of the German type, but modified to place the centroid of the various moving parts precisely over the center of the pier, thereby insuring maximum rigidity. The two axes, polar and declination, as well as the cradle, are made up of three-quarter inch steel plates which were cut to size and welded together. The tube is made of twenty gauge sheet steel, and has a diameter of 15 inches. The aggregate weight of the above parts is well over five hundred pounds.

The above mounting is anchored in a concrete pier which is in shape the frustrum of a pyramid. The pier extends six feet below the surface of the ground, is three and a half feet square at the bottom and tapers to a two foot square top, three feet nine inches above the ground level. The weight of the entire instrumnt, including counter-weights, finders, optical system etc., totals nearly three and a half tons.

The hour and declination circles are of black molded bakelite, the former graduated to five minutes of time, and the latter to single degrees of arc. The graduations are are filled with an oiled chalk and then lacquered.

The driving clock, while not as yet completed, will consist of a synchronus motor having one-eighth horsepower, and the customary worms and gears. The torque developed by the gear train will be applied to the polar axis through a friction clutch which is in dirct contact with the 240 tooth gear on the polar axis shaft.

The mirror, although of the Cassegrainian type, will be used at the Newtonian focus for variable star observations. At this focus, it has a focal length of 102.5 inches. The wide field so desirable for variable star work is obtained through the use of eyepieces having e.f.l.'s of 1.5 and 2 inches.

The telescope is being used entirely for the observation of faint novae, faint variables at their mimima and faint irregular variables. With an eye constant of 10, the theoretical limit of stellar magnitudes visible will be 15.7. A 15.8 magnitude star has already been observed under unfavorable conditions.

I wish to take this opportunity to express my most profound appreciation to Prof. Campbell, the AAVSO, and to the following members of the Milwaukee Astronomical Society, who helped in the successful completion of the project: M. Andersson, R. D. Cooke, M. M. Feinsilber, A. Fotsch, C. P. Frister, C. Fischer, R. Haertel, E. A. Halbach, J. Loepfe Sr., Wm. Liebscher, A. L. Peck, and Theo. Thompson.

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.

Starting with October, the society will hold its meetings on the first and third Thursday evenings of the month. The first meeting of the month will be a popular meeting and the second meeting will be of a technical nature. It is not possible at this time to announce the subject for the October technical meeting but we hope to be able to announce the subject at the first meeting. The meetings will be held at the Extension Division, University of Wisconsin as heretofore. The dates of the October meetings are the 4th and 18th. We hope for a good turn out at both meetings.

There will be a short meeting at the secretary's home at 8 P.M. on Monday, October 8th, to formulate plans for observing the Draconid meteor shower, which is likely to reappear this year, and also the Orionid shower. All meteor observers and those who would like to join this group are earnestly requested to attend this meeting or call Orchard 4582M.

CURRENT ASTRONOMICAL NOTES
M. F. Wadliegh

The Dark Galaxy: Dr. Joel Stebbins. A valuable hint to star photographers. Sc. Monthly, August.

Preparations of the 200 inch Pyrex Disk: Dr. S. V. McCauley (Corning Glass Works). A splendid detailed account with illustrations. The Telescope June, 1934.

The need for a 13th Month: M. N. Stiles. A thorough discussion of the pros and cons on this question. A real argument. Sc. Monthly, August.

Mysteries of the Solar Corona: H. N. Russell (Princeton University). A study of electrons leading to the solution of the problem. Sc. Amer. August.

Stratosphere Flight: p147 Sc. Amer. September. Unusual drawings with data and information.

THROUGH THE EYEPIECE
J. F. Loepfe

The Sun—In Virgo until the 24th then enters Libra.

The Moon—Phases: New Moon, Oct. 8, 9:05 A.M.; First Quarter, Oct. 15, 1:29 P.M.; Full Moon Oct. 22, 9:01 A.M.; Last Quarter, Oct. 30, 2:22 A.M.

Mercury—Evening star reaching its greatest elongation east on the 10th. Being in the southern sky it will be difficult to observe.

Venus—Morning star approaching the sun. Too near the sun to observe.

Mars—Morning star in Leo. On the 15th it will rise at 1:32 A.M.

Jupiter—Evening star until the 27th after which it will be a morning star.

Saturn—Evening star in Capricornus. Magnitude 0.8.

Electrical Phenomena that are Apparently of Instellar Origin

P. G. Jansky

During the summer and fall of 1931 and the year of 1932 there were carried on at Holmdel, New Jersey, a series of experiments on the direction of the arrival of atmospherics at high frequencies. As a result of these experiments it was found that electro-magnetic waves of unknown origin were detected. The data obtained from the records of the observation showed that the azimuth of the direction of arrival changed from hour to hour and from day to day in a manner exactly similar to the way in which the azimuth of a star changes. This fact led to the conclusion that the direction of arrival of these waves was fixed in space, that is to say, that the source of these waves is located in some region that is stationary with respect to the stars. The right ascension of the region from which these rays came was determined with considerable accuracy, that is, with an error probably not greater than plus or minus 30 minutes. The problem of determining the declination of the region was much more difficult because of the limitation of the apparatus and the error which might have been introduced by the ionized layers of the earth's atmosphere, and by the attenuation of the waves in passing over the surface of the earth. As a result of these difficulties the value obtained for the declination may be in error by as much as plus or minus 30 degrees. A summary of the data, however, indicates that the region from which the waves seemed to come has a right ascension of about 18 hours and a declination of about -20 degrees. The data seemed to point to a single source fixed in space with electro-magnetic waves travelling in more or less straight lines from the source and ultimately arriving at the recieving instrument.

Mr. Jansky suggests, in the discussion of his experiment, that there are other phenomena perfectly concievable which might give similar results. First, it is possible that the disturbances recorded may have actually originated in the earth's atmosphere in which case the results would indicate that these waves are a secondary radiation set up by some primary rays of unknown character which come from a source fixed in space. This hypothesis immediately sets up the question as to the character and force of the primary rays. It is possible that such rays might exist and might be composed of high speed particles charged or neutral. Such a possibility has been given added importance by an article of Gunn's on "Possible Stellar Origin of High Speed Ions", published in Terrestrial Magnetism and Atmospheric Electricity, Sept. 1933, page 247. In this connection it is interesting to note that there is a possibility that such waves might originate at a group of sources, rather than from a single source, and in fact if the rays were coming from a disk like source similar to the Milky Way, results very similar to those obtained would be evidenced. This hypothesis is extremely interesting when we consider that the coordinates given by the data for the source of the rays is nearly the same as for the center of the Milky Way which has a right ascension of approximately 17 hours, 30 minutes, and a declination of -30 degrees. This point would be well within the limits of error of the data.

(The original of this article, abstracted by G. A. Parkinson, appeared under the same title in Popular Astronomy, December, 1933.)

AMERICAN METEOR SOCIETY NOTES

Wisconsin-Northern Illinois Region

L. E. ARMFIELD

The observers of the Wisconsin-Northern Illinois regional network established for the observation of the Perseid shower deserve very special commendation for promise and are rapidly becoming a most excellent source of careful and precise cooperating so faithfully in the program. The observers of this region show great observations.

This month's report will be devoted to summarizing the number of meteors plotted by the various observing stations. Time coincidences and other details of the shower will be published in a succeeding issue of this bulletin.

Overcast skies were general throughout this region on the nights of August 9-10, 10-11, and 11-12. J. Wesley Simpson, regional director of the Missouri-Southern Illinois region also reported cloudy weather during the best nights of the shower. His region obtained twenty-four possible time coincidences, no photographs, and approximately 3800 meteors counted. More than fifteen meteors of magnitude -3.5 or brighter were reported by members of that region.

The number of meteors plotted by our members are as follows:

August 9-10—E. R. Reich, Marshfield, 3, V. J. Niebuhr, J. B. Vinson, P. M. Loofboro, Reedsburg, 4, G. Robinson, Hobart, Ind., 7.

August 10-11—E. R. Reich, 2, Frank Preucil, Joliet, Ill., 4, A. L. Peck, 1, C. P. Frister, 6, M. M. Feinsilber, 1.

August 11-12—Armin Deutsch, Chicago, 11, F. Preucil, 7, C. C. Steven, 2.

August 12-13—A. Deutsch, 28, V. J. Niebuhr, J. B. Vinson, P. M. Loofboro, 44, E. R. Reich, 16, P. Martz, Oak Park, Ill., 17, Miss M. E. Trimmier, Chicago, 44, F. Preucil, 5, E. A. Halbach, 5, A. L. Peck, 70, C. P. Frister, 10, Wm. Liebscher, 47.

August 13-14—E. A. Halbach, 10.

WORKING SECTIONS

Variable Stars: *H. L. Grunwald*— The members of this section reported 1328 observations for the month of August and are as follows: Armfield, 410; Mrs. Armfield, 108; Diedrich, 29; Frister, 70; Grunwald, 45; Halbach, 99; Houston,20, Loepfe, 123; Peck, 317 Miss Thurow, 107.

Occultations: *R. D. Cooke*— Four Occultations will be visible at Milwaukee during October and are as follows, Central Standard Time.

Date	Star	Mag	Immersion	Pos. Angle	Moon's Age
12	134B Scorpii	6.4	5:09 P.M.	111°	4.4 d
13	X Sagitt	4.4	5:55 P.M.	142°	5.4 d
16	19 Capr	5.7	9:28 P.M.	100°	8.6 d
20	lambda Pisc	4.6	2:18 P.M.	80°	12.6 d

Meteors: *E. A. Halbach*— All members interested in meteors are earnestly requested to get lined up with the continuous observing program. Only four nights of the week have been definitely assigned. Get in touch with the leader of this section by calling Hilltop 7926.

We wish to commend the following observers for their work on the continuous program. Number of meteors plotted and hours observed follow the observer's name: M. M. Feinsilber, 42 - 14h 45m; A. L. Hady (report incomplete) 7 - 3h 30m; E. A. Halbach, 43 - 11h; A. Katz, 21 - 2h 30m; Wm. Liebscher, 130 - 37h 45m; N. Menzel 0 - 2h 30m; A. L. Peck, 5 - 1h 15m; C. C. Steven, no report.

A lecture and demonstration are planned for the October popular meeting to show how meteor observing is done.

The M A S Bulletin

Published Monthly by the Milwaukee Astronomical Society

Vol. 1, No. 10 | NOVEMBER, 1934 | Ten Cents

CEPHEID VARIABLES

The term Cepheid is used to denote a shower of meteors having its radiant point in the constellation Cepheus. The word also means a certain kind of variable star, the most typical of which, Delta Cephei, has given its name to the entire group. This kind of variable has many characteristics: they vary only about one magnitude in brightness, the periods range from a few hours to about fifty days, their mean light curves show a sudden rise to maximum which takes about one third of the entire period, then a slow decline to minimum in the course of which there may be a more less accentuated halt. Among the Cepheids are a few which may be termed super-giants; they are yellow in color and have a tremendous luminosity.

The variability in magnitude of the Cepheids was first thought to be due to the fact that the Cepheids are spectroscopic binaries, the component parts revolving around each other, but Eddington disproved this theory when he mathematically calculated that the orbit of the secondary star would be inside the orbit of the first star. Shapley of Harvard has advanced a pulsation theory and that is the one now generally accepted: the star is single, and under the action of gravity it contracts until it reaches a point where the excess heat caused by the contraction expands the star until it is sufficiently cooled to again contract.

In 1912, Miss Henrietta Leavitt of Harvard studied a small group of Cepheids in the small Magellanic Cloud, and she noticed a revelation between the apparent magnitudes and the lengths of the period: the longer the period of vibration, the brighter the star. More variables were then observed and carefully noted, from which a conclusion was reached that proved to be a tremendous step forward in astronomical research, namely that if one knew a Cepheid's time of variation, one could determine its absolute magnitude and from that its distance. Shapley worked out what he calls a period-luminosity curve from which one can read, knowing a Cepheid's period, its absolute median or average photographic magnitude, then, by mathematical formula, easily determine its distance. In this way the parallax of many stellar objects such as the Magellanic Clouds have been determined from the Cepheids observed therein, and they have proved to be farther away than ever before imagined, thereby increasing many fold our former conception of the size of space and of the normity of stellar distances.

Shapley's book, Star Clusters, contains an explanation of his period-luminosity curve, and discusses Cepheids and their place in evolution of stellar knowledge.

Mention has been made that the average period of Cepheids is seven and a half days. Very recently the shortest period variable ever known was discovered in Germany. It is a Cepheid having a period from maximum down to minimum and back to maximum of only eighty-eight minutes. Its magnitude range is between ninth and tenth magnitudes. It's right ascension is $22^h\ 30^m\ 22^s$; declination, $+0°\ 47.9'$. As yet no official notice of it has been made in this country.

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 November meeting of the Junior Auxilliary will be held at 7:00 P. M. Nov. 1 at the University of Wisconsin, Extension Division. Mr. H. W. Cornell will give a talk on the Leonid Meteor Shower. The Juniors will have as their guests a group of thirty Boy Scouts.

The regular November meetings of the society will be held at the University of Wisconsin, Extension Division, at 8 P. M. The popular meeting will be held on the 1st and the Technical meeting is scheduled for the 15th. These two meetings a month are proving to be a success. At the popular meetings we hope to work out an extensive program of an educational nature.

The main astronomical event for the month of November is the hoped for return of the Leonid Meteors. The meteor section of the society together with the cooperating stations throughout the state of Wisconsin and Northern Illinois are planning an extensive program. We need your help. Please get in touch with the leader of the meteor section of the 10th of the month.

WITH OUR EXCHANGES

The Milwaukee Astronomical Society has been receiving regularly the following publications from other amateur astronomy societies:

The Astronomical Discourse, published by the Missouri-Southern Illinois Observers at Webster Groves, Mo. This is a very note-worthy publication covering a large number of interesting articles.

The Texas Observers' Bulletin, published by the Texas Observers, at Fort Worth, Texas. Copies of this publication in addition to its interesting and timely articles are generally accompanied with photographs of special astronomical interest.

The Southern Appalachian Observers' Circular, published by the Southern Appalachian observers at Knoxville, Tenn. This publication contains much interesting material.

The Amateur Astronomer, published in New York, makes its appearence four times a year. In addition to Astronomical articles this publication contains quarterly star maps.

These publications are on file at our Society's library and it is hoped that the members of the society will make use of them.

We hope that as time goes on to increase the number of our exchanges by making contacts with other amateur astronomical societies.

THE SIZE OF THE GALAXY

G. A. Parkinson

Measuring the size of the galaxy has been one of the problems which has received a great deal of attention from astronomers in recent years. The latest information regarding this problem comes from a publication of the Washburn Observatory which has been released quite recently. The work was

done by Professor Joel Stebbins, Director of the Observatory, and Dr. C. M. Huffer, assistant professor of astronomy.

The results of the paper were obtained by the study of 733 blue stars. The study was made with the aid of a proto-electric cell and an amplifier in a vacuum chamber attached to the Observatory's telescope. The investigation confirmed the exsistence of a thin layer of dark, scattered material in the Milky Way Galaxy. As the light of the stars pass through this thin layer of the dust the shorter blue and violet waves are broken up and the longer red waves pass through. Similar layers of dust probably cause the appearance of the dark band in the photographs of extra-galactic nebulae which are seen on edge from the earth. While the final corrections and estimates of distances have not yet been completed, it appears that these investigations will reduce the size of our galaxy by about one-half, which will make it quite comparable to the sizes of the other large galaxies rather than twice as large as has been supposed. In 1922 Kapteyn estimated the diameter of the galaxy to be 56,000 light years. More recently Shapley has estimated it to be about 200,000 light years. The work of Stebbins and Huffer will probably cut the figure of Shapley in about half.

It is probably surprising to most people that a problem such as this has caused astronomers so much trouble. A brief survey of the factors involved will show why these estimates can vary as much as they do. As light leaves a star and passes toward the earth, a number of factors cause it to become red. The principal causes of this phenomenon are first, the velocity of the star with respect to the earth in the line of sight; the second is the distance of the star; and the third is the obstruction of the shorter waves of light by interstelar particles. The first factor causes a definite shift of the spectrum toward the red end, if the star is receding from the earth. This change of wavelength is called the Doppler effect. If the star has a velocity v with respect to the earth, and V is the velocity of light, and if a lambda is the wavelength of the light, then the change in the wavelength delta lambda is given by the following formula: delta lambda is equal to v X lambda / V. The second factor which causes a displacement of light toward the red end of the spectrum is due to the distance of the source of light from the observer. This was first predicted by the theory of relativity. According to this theory if an observer is measuring the period of vibration of an atom this period will appear to increase as the distance of the atom form the observer increases. This apparent slowing down of the vibration results in another shift of the light toward the red end of the spectrum. The third factor which causes such a phenomenon is the existence of dust in interstellar space. As light passes through dust the shorter violet and ultra-violet waves are broken up and the red waves pass through undisturbed. Nearly everyone has noticed a similar phenomenon when he looks at a street light on a foggy night. The light appears much redder than ordinarily.

In measuring the distance of stars and observing their light, it has been until quite recently impossible for astronomers to separate these two factors. That is, they could not tell just how much of the displacement toward the red was due to distance and how much was due to dust in interstellar space. The recent work at Washburn Observatory indicates that the reddening due to dust is much larger than has heretofor been thought, and as a result there is much less reddening due to distance. Hence, it would appear that many of the distances must be greatly reduced to compensate for the effect of the dust in the new observation.

AMERICAN METEOR SOCIETY NOTES

Wisconsin-Northern Illinois Region

L. E. Armfield

The following statement was contained in a communication recently received from Dr. Charles P. Olivier and pertains to the 1934 Leonid Meteors:—"We hope for an expiring but good Leonid Shower this month. It is our last hope for several fireball trains on one night and is one reason why I will make all efforts to observe it here in the East. I trust your section will give it their best attention."

In view of the excellent results obtained through the untiring efforts of this region during the 1933 Leonids it is hoped that additional data will be gathered this year. The usual letters requesting cooperation will have been received by the regular observers by the time this Bulletin is published; the following call for aid will therefore not be applicable to them.

Will all persons residing in Wisconsin or Northern Illinois, who are not as yet members of the American Meteor Society; or those members not included on the list of active observers, but who are interested in observing a few hours or all hours after 11:00 P. M. on the nights of November 14-15, 15-16, and 16-17 please drop a postal card immediately to either Dr. Charles P. Olivier, Flower Astronomical Observatory, Upper Darby, Pennsylvania or L. E. Armfield, 2046 S. 59th Street, Milwaukee, Wisconsin. Please inform us of the dates and contemplated hours of observation as well as the extent of previous experience

As promised in the October issue a summary of meteors observed whose time coincidences appear to be of sufficient accuracy to warrent real height computations is included below.

The Reedsburg station, manned by Vernie J. Niebuhr, Paul M. Loofboro and J. M. Vinson, which was cooperating with the Marshfield station under the local direction of E. R. Reich obtained three coincidences out of three paths plotted on the night of August 9-10. Cloudy skies made further work impossible. On August 12-13 these two stations contributed 6 additional time coincidences out of 16 plots. Miss Trimmier of Chicago added 16 more to the list; Mr. Armin Deutsch also of Chicago, 8; Mr. Erwin P. Martz of Wilmette, 7; Mr. Frank Preucil, Joliet, 3; A. L. Peck and Wm. Liebscher plotting alternate meteor paths at Milwaukee in cooperation with the Chicago and Joliet stations recorded 15 paths whose time occurrence corresponded with those obtained at the above stations.

The results obtained are indeed most excellent and indicate very strict adherance to the observing plans on the part of all participating members. The intelligence and enthusiasm displayed by all members of this region is truly exceptional as well as the most perfect cooperation which is received at all times. With so many attributes for success, this region cannot help but make many valuable and additional contributions to Meteoric Astronomy. The AMS wishes to extend its grateful appreciation to each and every one of you for such fine work.

Mr. Armin Deutsch of Chicago has from time to time submitted observations of sporadic meteors observed during the past summer and on his vacation. These observations are of much value and it is hoped that others will consider observing for at least an hour or more on a few nights between showers at their convenience. Mr. Halbach, through the cooperation of the members of the meteor section of the Milwaukee Astronomical Society has inaugurated a continuous meteor observing program which has shown much promise. Information will gladly be furnished upon request.

The M A S Bulletin

Published Monthly by the Milwaukee Astronomical Society

Vol. 1, No. 11 DECEMBER, 1934 Ten Cents

THE CRESCENT OF VENUS

H. W. Cornell

Every reader of this publication knows that Venus goes through phases similar to those of the moon, and that it is largest when in the thin crescent phase. At this time its angular diameter may reach sixty-seven seconds of arc, or about one twenty-seventh the apparent angular diameter of the moon, an amount which is just on the theoretical limit of naked-eye vision. Many text books on astronomy contain the statement that the crescent phase may be seen with very slight optical aid, an opera glass being sufficient, but not with the naked eye. However, it may be seen with the naked eye under extremely favorable conditions, as the writer has proved for himself.

The discovery of the phases of Venus is generally ascribed to Galileo, who, uncertain of his discovery but wishing to establish the finding for himself, published a curious anagram, as was the custom of the time. It contained a Latin sentence, with two left-over letters which he was unable to place:

"Haec immatura a me jam frustra leguntur o y." (These undeveloped things are read by me only in vain). Some months later, after he had made sure of his discovery, he published the rearrangement of the words of the sentence:

"Cynthiae figuras aemulatur mater amorum." (The mother of love imitates the shapes of Cynthia), that is, Venus imitates the phases of the moon.

But was Galileo the first to know of the crescent of Venus? Years ago, when I was a lad in High School, I read of a Chaldean inscription which depicted the goddess representing the planet Venus with a crescent emblem. An archeologist argued that this must mean that the Chaldeans had invented the telescope, and he tried to demonstrate that the knowledge of astronomy possessed by the Chaldean priests was too extensive to account for without telescopic aid. He concluded that they possessed telescopes, or at least a telescope, perhaps as good as Galileo's. The crescent of Venus was his weightiest argument.

But could not that crescent have been seen with the naked eye? In an endeavor to solve this question I watched Venus when it was morning star, very close to inferior conjunction. Before the sun rose, the irradiation from such a bright object was so great that not even with good opera glasses could any crescent be seen. As daylight advanced, Venus became very hard to see at all. For minutes at a time I would lose it. Yet its brightness was still great enough for the irradiation to obscure the crescent. Then I had a rare bit of good luck. An eighth of a mile away (which, for naked eye observing, is an optically infinite distance, that is to say, the eye focuses the same as for the stars) there was a factory. It blew a whistle to summon its early shift of workers. As the cloud of steam arose from the whistle it passed in front of Venus. Carefully I watched that cloud of steam, my eye, focused on it, being thus adjusted to see the planet itself. The cloud of steam slowly dissipated, and, for two or three seconds only, the crescent clearly appeared to my unaided eye. Then the steam entirely disappeared, and the crescent, too, was gone. Quickly I looked with opera glasses, the crescent was at the exact angle at which I had seen it with the naked eye. There was no illusion. Neither was there a magnifying power in the steam. A cloud of dust, such as is common in the Chaldean deserts, would have done as well.

The Chaldean who saw that phenomenon over five thousand years ago must have had patience, good eyesight, persistence, acuteness, and exceptionally good physical conditions. Granted these, and he could have, and doubtless did, see the crescent of Venus. I did—but only once. I consider it my most remarkable naked eye observation.

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.

At this time we wish to extend to the Members and Friends of the Milwaukee Astronomical Society the Season's Greetings.

The December meeting of the Junior Auxilliary will be held at 7:00 P. M. Dec. 6 at the University of Wisconsin, Extension Division. Mr. F. L. Dieter will give the lecture of the evening.

The regular December meetings of the society will be held at the University of Wisconsin, Extension Division, at 8:00 P. M. The popular meeting will be held on the 6th and the technical meeting is scheduled for the 20th. Prof. Joel Stebbins of Washburn Observatory will speak at the Dec. 6 meeting. The subject will be "Recent Work at Wasburn Observatory."

The Geminid Meteor shower will be with us this month. Their maximum will come on the 12th. Plans will be made at the December Popular meeting for their observation.

SOLAR RADIATION

G. A. Parkinson

Most of us have a vague idea that the sun radiates a great deal of heat, light, and energy, but few of us have considered carefully the methods by which such radiation can be measured or the quantitative results of such measurements. The method of procedure is to measure accurately the intensity of sunlight at the surface of the earth under very favorable conditions, and then to estimate the amount of intensity which has been absorbed by the passing of light through the earth's atmosphere. Knowing the mean distance of the earth from the sun and the intensity with which the sunlight strikes the outer atmosphere of the earth, it is possible to compute with a fair degree of accuracy the amount of heat, light, and energy which is being radiated.

In 1913 Kimball measured the illumination of the sun at the zenith and found it to be about one hundred and three thousand meter-candles. On the basis of this he estimated that the illumination just outside the earth's atmosphere is about one hundred and thirty-five thousand meter candles. This means one hundred and thirty-five thousand times one candle power at a distance of one meter. This is about 465.000 times the intensity of the mean full moon and about 9 million times as great as the intensity of the light received from Venus at her brightest period and is about 11,400 million times the intensity of the light received from Sirius, the brightest of the fixed stars. The candle-power of the sun is then

found by multiplying 135,000 by the square of 1.495×10^{11} (the number of meters in an astronomical unit) which gives 3.02×10^{27}. Since the surface area of the sun is about 6.07×10^{22} square centimeters, we see that a single square centimeter of the sun's surface shines with the light of about 50,000 candle-power. This shows us that the sun's surface brightness is about 600,000 times that of an ordinary candle flame.

In considering the problem of solar radiation it is necessary to remark that there is a distinction between the light radiated from a luminous source and the energy radiated. The problem of the accurate determination of the intensity of the sun's energy of radiation is a very important and interesting problem. This energy is measured in terms of a number called the solar constant. Abbott, on the basis of a large number of observations, estimates it to be 1.938 calories per minute per square centimeter, just outside of the earth's atmosphere. These measurements were made by an instrument called the pyrheliometer. It is an instrument in which the radiant energy of the sun of all wave-lengths is transformed into heat, and then measured in calories. A calorie is the quantity of heat required to raise one gram of water one degree Centigrade. The term solar constant is somewhat misleading since actually this number represents the intensity of the sun's radiation is slightly variable and may differ from the above-mentioned value by as much as .05 of a calorie per minute per square centimeter.

All of us have from time to time heard about the solar engines which have been built to utilize this tremendous energy and are interested in knowing what the total amount of energy is. In order that we may reduce the quantity under consideration to more familiar units, we must remember that one calorie of heat is equivalent to 41,860,000 ergs. Ten million ergs per second constitute one watt of electrical power and 746 watts are the equivalent of one-horse-power of energy, which is equal to 33,000 foot pounds per second. Abbott's value of the solar constant, then, corresponds to about 1.88 horse-power of energy per square meter. This is equivalent to 4,690,000 horse-power of energy per square mile. If the total solar radiation which strikes the earth in a single second could be converted into power its value at the rate of one cent per kilowatt hour would be $478,000,000. When we consider that the total amount which strikes the earth is only one part in 2,200,000,000 of the total energy radiated by the sun, we get some conception of the enormous amount of such radiation.

We have now computed the amount of energy radiated by the sun which reaches out into space a distance of about 93,000,000 miles. We are now ready to compute the total amount radiated at the surface of the sun itself. When we complete our computations we find that it is equivalent to about 89,500 calories per square centimeter per minute, and this amounts to about 84,000 horse-power for every square meter of the sun's surface. The heat of this radiation would melt a shell of ice 40 feet thick around the entire surface of the sun in one minute. The entire heat of radiation of the sun amounts to 5.08×10^{23} horse-power (508,000 billion billion). If all this energy would be set at work drawing the earth away from the sun against the pull of gravitation, it would be sufficient to pull the earth entirely away from the sun and into infinite space in a period of six months.

AMERICAN METEOR SOCIETY NOTES

Wisconsin-Northern Illinois Region

L. E. Armfield

Dr. Charles P. Olivier, the world's foremost authority on Meteors, and Professor Cuno Hoffmeister of Germany, the leading meteor authority in Europe, have entered into a cooperative agreement for the purpose of attacking the problems of annual and daily variation of meteor frequencies. Inferences are to be drawn with respect to distribution and velocities of meteors in space. The American Meteor Society through Dr. Olivier is to furnish the observational data and Professor Hoffmiester will do all the necessary computing for the solution of the problems.

While much data is at present available in the files of the AMS there are certain very important points that are weak in observational material for a most comprehensive study of the problems. Consequently, Dr. Olivier has greatly honored the members of the Wisconsin-Northern Illinois region by requesting their cooperation in securing the data necessary to supply the information needed.

Nearly all members of this region have heartily agreed to participate in an extensive campaign, beginning immediately and running through to January, 1936. The major objective of the campaign is for counts running several hours consecutively, several times per month. The counts are to be at least three hours long, some in the early half and some in the latter half of the night.

The Olivier-Hoffmiester program offers a splendid opportunity for the amateur to contribute his share towards the solution of a very major problem of Meteoric Astronomy—and, with no equipment, other than perserverance and the naked eye.

The publication of the results will give due credit to all lending their aid, to the AMS as a society as well as to individual observers. Those of you, who are spending your leisure time in a pursuit of this nature are doing much, which will not only live after you, but will live with you. Your efforts are being appreciated, and you may be assured that such fine cooperation will lead to untold results not only for this particular problem of Meteoric Astronomy but for Astronomy in general. The writer will gladly provide detailed information to any one interested in taking part in this very worthwhile project.

A network of ten stations and 61 experienced meteor observers from the Wisconsin-Illinois region were well equipped to receive the Leonids. The AMS wishes to express its grateful appreciation for the beautiful spirit of cooperation displayed by each and every one of the 61 observers participating in the program. While they were not awarded with a brilliant spectacle of flashing meteors, it is hopeed that any disappointment experienced may be some what mitigated with the thought that the verification of the Leonids' failure to return in great numbers is just as important scientifically as a spectacular display.

The following rates were obtained by the counters of the meteoric section of the Milwaukee Astronomical Society. The nights of November 14-15 and 15-16 were brilliantly clear and exceptionally mild. A balmy breeze from the southwest, bringing a touch of spring on the night of the 16-17 also brought clouds which did not clear away until 15:45 and then only for slightly more than an hour.

Date	Hour	Rate	Date	Hour	Rate
November 14-15	12:00 to 13:00	3		13:00 to 14:00	8
	13:00 to 14:00	17		14:00 to 15:00	35
	14:00 to 15:00	21		15:00 to 16:00	30
	15:00 to 16:00	16		16:00 to 17:00	34
November 15-16	12:00 to 13:00	4	November 16-17	15:45 to 16:45	25

300 paths were plotted by members of this section during a total of ten hours observing time. Detailed summaries for the entire region will be published in succeeding issues of this bulletin.