THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

SASKATOON CENTRE

President: Halyna Kornuta
Editor: Greg Towstego
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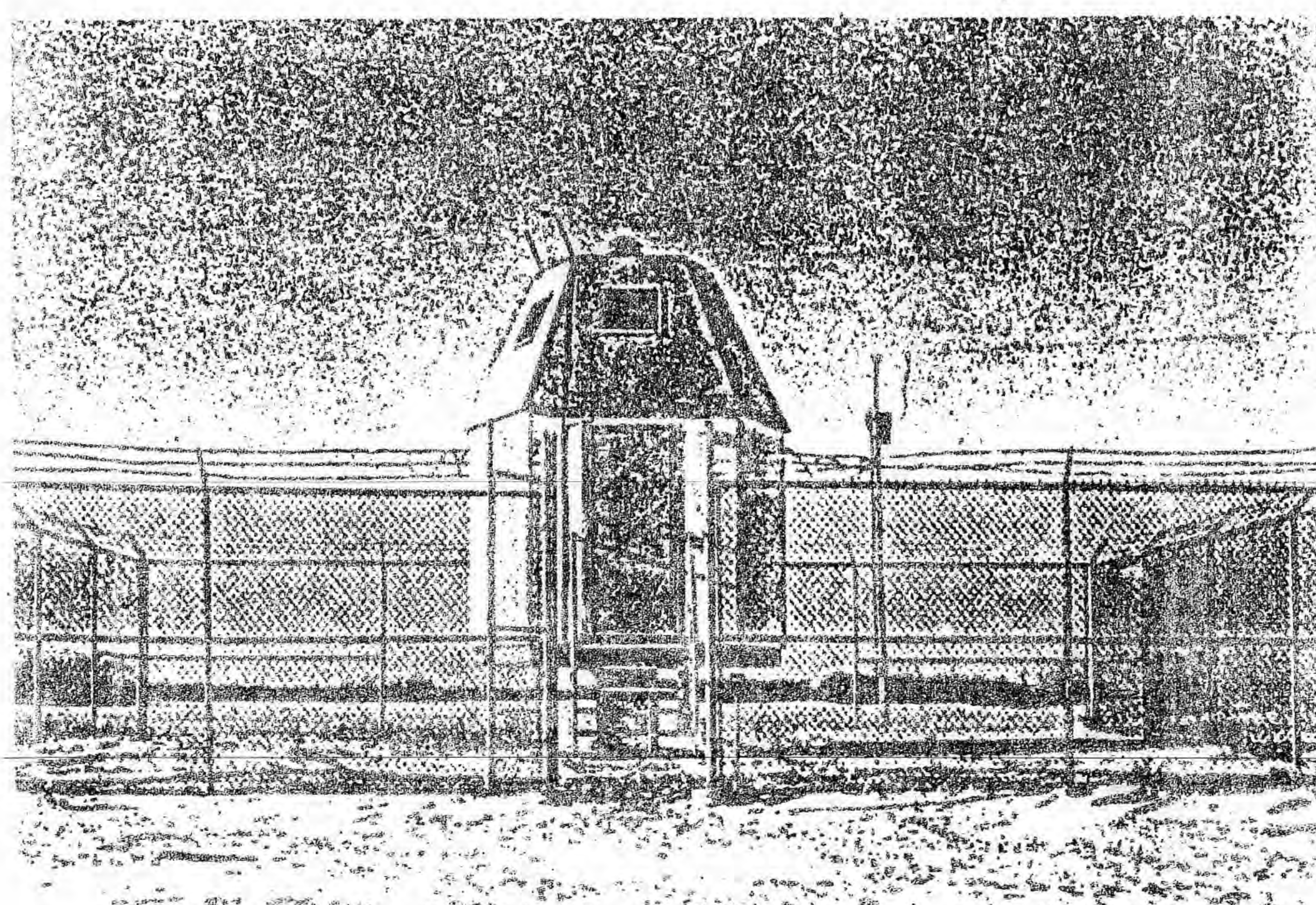
NEWSLETTER



METEOR FLUX SURVEY

ALAN BLACKWELL, NRC METEORITE PROJECT

It is of interest to try to answer the question, "How many meteors enter the earth's atmosphere per unit area per unit time?" In other words, "What is the meteor flux?" The question might also be refined to consider separate groups of meteors having common characteristics, such as speed, brightness, or height at extinction. Furthermore, if we could make use of a theory relating observable characteristics (such as brightness and velocity) to the mass of the meteoroid, we could use the flux data in estimating the rate at which mass is accreting on the earth (keeping in mind, of course, that only bright meteors are observed in this project, and these are not the only source of mass influx, and perhaps not the largest source either). Only a program of regular surveillance of a large area of sky can answer these questions. The Meteorite Observation and Recovery Project (MORP) operates 60 cameras which photograph the sky constantly during darkness. The area of sky watched is about 1.5 million square kilometers. Since this is about 0.8% of the world's total land area, and is in the Canadian prairie provinces where the sky is reasonably clear, MORP has a good capability for obtaining data on the meteor flux.

SKY CONDITIONS

A comment about clear skies is in order because because a somewhat surprising result has been obtained. The clearness of the sky is regularly determined as a byproduct of the data analysis, and the result is unexpected when one remembers the reputation of the west for clear skies. The sky is, by the criteria used in this study, completely obscured 68% of the time and completely clear only 6% of the time. This assessment is made on the basis of the visibility of star trails, and a few small breaks in the trails are actually tolerated before the classification of seeing is downgraded. There is, however, a tendency to be cautious, because the flux statistics would be distorted if some sky were classified as clear when, in fact, one could not have seen a meteor in it. The percentages given here were obtained from 29,000 hours of observation at 12 stations in 3 provinces over one year, and, of course, they relate only to observations during hours of darkness.

PROCEDURES

MORP obtains about 200,000 pictures annually. The time of every picture is known and every picture is examined for 4 purposes:

(1) to discover pictures of meteors,
(2) to record the time interval of the picture,
(3) to record whether the sky was clear enough for a meteor to have been seen if it had occurred,
(4) to detect operational malfunctions of the camera system.

the examining technician records the information about time, sky conditions, and meteors, as he is looking at the film, by typing on a keyboard which is a terminal to the ibm 370 computer. A group of computer programs provides the following outputs:

(1) the daily values of area-time obtained by multiplying the area of clear sky seen by 2 or more cameras times the duration of that coverage (the sum of these products forms the denominator of the flux calculation);
(2) maps of the prairie region showing total clear sky coverage at selected times;
(3) a list of meteors, with the ones that were in areas of clear sky singled out (the subset of these consisting of meteors seen by 2 or more cameras forms the numerator of the flux calculation);
(4) an analysis of the operating characteristics of each observatory, in order that faults may be detected;
(5) a graph of the error on each camera clock, determined from the regular time checks performed by each observatory operator; with corrections thus determined, the timing in this project is generally accurate to a second.

Obviously, not all meteors are seen. The difficulty in these studies lies not in counting meteors but in determining a "fair" value for the area and duration of observations. It would obviously be "unfair" to include in the flux denominator any area or time period in which a meteor would not have been noticed if it had occurred. It is therefore essential to determine the total amount of effective observing in what is classified as "clear sky". For the purpose of the flux survey, the sky is defined to be a spherical surface 70 km above the earth. This is the flux surface. That height was chosen because most meteors which are bright enough to be seen by the MORP cameras are going to be visible at 70 km. A limit on the bottom of the camera field of view restricts the observations to within 400 km of the observatory, since at greater ranges the cameras would not see any but the very brightest meteors. The sky surface is considered to be segmented into 14400 rectangular cells. Each cell is about 25 km by 32 km and contains 780 square kilometers. That, then, is the degree of resolution of the prairie sky, and it is a compromise between more costly computation and more precise delimitation of the area that qualifies for clear-sky multiple-camera coverage. Each camera sees many of these cells, so that about 600 are covered by each 5-camera station. The total area of multiple-camera coverage is about 1.26 million square kilometers.

The time period of the observations must also be segmented, and for this purpose half-hour time slots are used. If the beginning or ending of a picture extends more than 15 minutes into a 30-minute slot, the whole slot is assigned the characteristics of that picture. If there are several pictures within the same slot (an unusual situation), the characteristics of the longest one prevail. A typical picture lasts about 2 hours, and if it has happened that clouds arrived during the picture, the entire coverage of that picture is excluded from the survey because of the difficulty of apportioning acceptable and unacceptable observing intervals.

In deciding which meteors to include in the flux count, it is important to follow the same criterion as used for deciding which sky coverage shall be included. Each picture is divided into 4 quadrants. If the sky is reasonably clear in a quadrant, then that quadrant is tentatively marked for inclusion in the sky coverage. If a meteor is in that same quadrant, the meteor is tentatively marked for inclusion in the flux count. If a meteor is seen in sky that would not ordinarily be included in the coverage, neither the meteor nor the sky coverage is included. Great care is taken to assure that the assessment of the sky condition is not influenced by the fact of actually seeing a meteor in it--the criterion must always be based on the visibility of star trails. When all the film for one day has been examined, a computer program finds which cells appeared clear at 2 or more stations, and only these multiple-coverage cells contribute to the final area counted in total coverage. For the numerator of the flux calculation, a meteor will be counted only if there are two or more pictures of that same meteor and if it passed through cells of sky which were counted in the total of coverage area. The requirement of 2 pictures is necessary because with only one picture the position of the meteor cannot be accurately determined and it would not be possible to know if the meteor passed through sky cells which are part of the acceptable sky coverage.

Sometimes the film searching turns up one picture of a meteor seen in clear sky, but no matching picture from another station. To keep the statistics pure, as explained in the preceding paragraph, these meteors are not included in the flux count. The possible reasons for missing meteor pictures are:

(1) the meteor may have been visible but was missed in the examination of the other picture. However, a missing mate is always looked for a second time on the film of the other stations which had clear sky at the time of the meteor, so this explanation is generally a temporary one.

(2) the meteor may have been too faint to be seen on any other picture. There is no remedy for this, and the implication is that faint meteors are not completely covered in this survey.

(3) the meteor may have been in a part of the field of view which was not seen by another camera. (There are a few small gaps in the coverage, and it also happens occasionally that some camera is out of service for repairs.) Such a meteor is not included, and this is fair because the cell in which it occurs would not have been counted in the total sky coverage.

(4) the meteor may have occurred near sunrise or sunset at a time when the other cameras were not taking pictures. Again, the exclusion of the observed meteor is fair because the cell in which it occurs would not have been counted in the total sky

coverage.

In the development of the procedures and programs for this flux survey, there have been several situations in which the method could have been more rigorous or less rigorous. The choice has always been in favour of rigour and in favour of conservative policies in accepting sky coverage for inclusion. The effect has been to slow down the rate of accumulating observing time, but by applying the same strict standards for the admissibility of contributions to the numerator and denominator, the accuracy of the flux calculation should be great.

RESULTS

this program is relatively new, and so far data has been analyzed for about one year, ending last March 25. In this period, MORP obtained 394 meteor pictures over 363 days. This is not a large number of pictures, but it must be noted that the MORP cameras are designed to capture pictures of reasonably bright meteors only -- brighter than about minus 6th magnitude. Among these meteor pictures were 59 meteors that were photographed by two or more stations. Although any of these 59 meteors could have been traced down to an impact point if they had reached the ground -- which they did not -- only 21 of them were seen in the clear sky that was included in the flux survey. The total of observing in clear sky was 391 million square kilometers * hours. Dividing this into the 21 meteors determines that the meteor flux is 5.4 * 10**-7 meteors per hour per square kilometer, or, if one prefers the cgs system, 1.5 * 10**-21 meteors per square centimeter per second. Another way of looking at this is that over the 1.26 million square kilometers of sky watched, there is a meteor every hour-and-a-half.

Certainly, this program cannot be considered complete until the meteors have been classified according to brightness and the flux at different magnitudes determined. The program of course, is also far from complete with only 21 meteors in the statistics. At this preliminary stage, however, it is interesting to note that the single number quoted above for the flux is in very good agreement with the data published by McCrosky in 1968. His data was based on 82 meteors, and was also plotted over a range of brightnesses. The MORP data fall on his curve if the faint limit for meteors in this survey is absolute photographic magnitude of minus 6, which is just about what it is. When more meteors have been photographed, it will be desirable to present the same sort of distribution data as an independent check, and an extension, of that earlier work.

******** END ********


ALBERTA
SASKATCHEWAN
MANITOBA
EDMONTON
VEGREVILLE
LOUSANA
CALGARY
BROOKS
NEILBURG
LEADER
SASKATOON
ASQUITH
WATSON
ERNFOLD
REGINA
LAJORD
LANGENBURG
BIRCH RIVER
ALONSA
WINNIPEG
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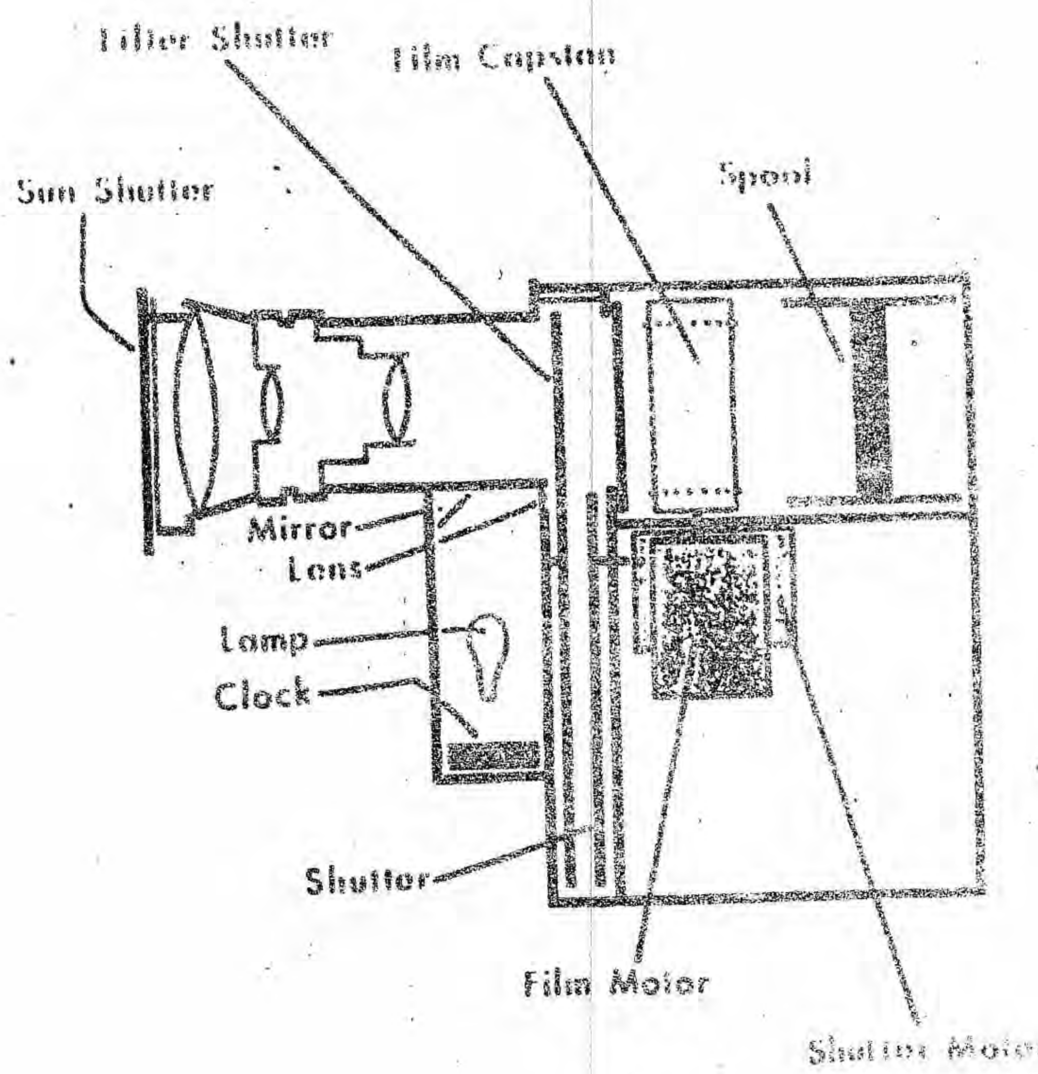
MORP CAMERA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Film Capstan
Sun Shutter
Spool
Mirror
Lens
Lamp
Clock
Shutter
Film Motor
Shutter Motor

VANCOUVER CENTRE COORDINATES ECLIPSE TRIP TO AUSTRALIA

This article isn't going to sell one trip to Australia. But that's okay; it isn't supposed to. What it might do is convince those of you who are confirmed eclipse chasers, that you should band together and go as a group. If you just ignore the cameraderie, exchange of ideas and projects, and general travelling companionship, there is still one very good reason to go together; IT'S CHEAPER!

The Vancouver Centre is working on plans to organise every eclipse chaser from Halifax to Victoria into a comprehensive tour group. Using the resources of the MacMillan Planetarium, and some essential cooperation from Australian amateur astronomers, Canadian Pacific Airlines, and officials of Australian and Hawaiian observatories, we hope to put together an eclipse package that will make everyone happy. Here's what we've done so far........and here's what you have to do.

To begin with, it's a break-even venture. It is not some travel agency's idea of what amateur astronomers need. The tour will be about three weeks duration. It will get the amateur from any location in Canada to Vancouver. From there, it's off to Nandi, Fiji (it is a fuel stop and doesn't cost extra so we might as well see it), and then to Sydney. Arrangements there will be made for accomodation, trips to the observing site, trips to Australia's famous radio telescope installations, and the usual tourist tours (pub hopping.) We hope to get our Australian counterparts (the R.A.A.S.) to do a lot of the leg work on this.

On the return leg of the trip, there will be a stop in Hawaii (because again it doesn't cost extra). Though we can't guarantee anything, we're working on getting access to the Observatories on Mauna Kea. If you have not heard, Canada, France and Hawaii are building a 141" telescope atop Mauna Kea. Finally, its back home to rainy or cold Canada.

Well, there's the outline. At this stage, nothing is set. We can't even tell you what it will cost except that it is bound to be astronomically expensive (I wish I hadn't said that.) We can tell you what you'll save going as a group.

To begin with, we hope to get access to all the sites that would interest an amateur astronomer. We also hope to have the Royal Australian Amateur Astronomical Society make many arrangements for us (they charge less than travel agents.) Travelling as a group (20 or up) we save $400.00 or more per person on the airfare. We've made special arrangements with the airlines involved so that telescopes and other equipment will get special handling and will not be subject to excess baggage charge (this amounts to about $50.00 for a telescope.)

The Vancouver Centre doesn't get anything out of this; other than the fact that a handful of our members will be going. We have the contacts in the right places, and, by doing a lot of the organisation, we can get a break on many of the charges.

What we need most, is some indication of how many people across the country might be interested in going. We know of a few from Vancouver, the usual handful of Richards from Ottawa, Ken Chilton from Hamilton (if the station pays), but what about the rest of you?

If you are even vaguely interested, could you drop us a note as soon as possible. By that time, we should have a more definite idea of what we might do, and how much it might cost. Incidentally, the eclipse is 3:50 in duration and takes place after lunch but before cocktails.

Lets hear from you. Thanks.

Vancouver Centre,
Royal Astronomical Society of Canada,
3100 Chestnut St.,
Vancouver, B.C.
V6J 3J9

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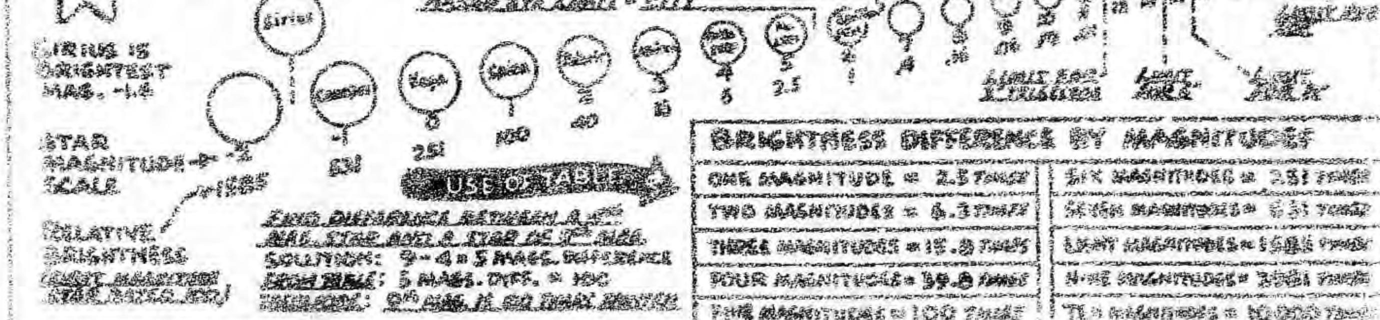

OBSERVING THE THIN LUNAR CRESCENT (Greg Towstego)

Every month, slightly before and after the new moon, a very thin lunar crescent can be observed. (ie. less than 48 hours old) Such a thin lunar phase is very beautiful and is a good subject for photography. As part of a General Assembly project (category 3), Mr. G.N. Patterson prepared data sheets telling when and under what conditions this phenomenon may be observed. (see next page)

The new moon for February will be on Sunday 29 Feb. The crescent can be observed just before sunrise on Friday 27 Feb. and just after sunset on Monday 1 March. As is shown on the next page, there will not be much time to observe this as the sun will rise in the first case, and the moon will set in the sunset case. The data sheet also gives the altitude of the moon above the horizon. The symbol (≠) means approximately.

If you plan to photograph it, be ready beforehand. You will not have much time to take pictures once you see it. The moon won't wait for you. It can be photographed with a standard camera lens, however, it would be much better if you had a telephoto lens or telescope to photograph it with. To qualify for the General Assembly, some members have been taking only black & white photos of it, however, once we saw how beautiful it was, we decided that next time we would also take colour slides. (these could qualify for category 12 at the Assembly, best set of colour slides of any three astronomical subjects) At sunrise on Thursday 29 Jan., Mr. Gordon Patterson and myself took black & white pictures through the Celestron-8. As he went out to prepare, I loaded my Pentax camera with Plus-X film (ASA 125). When I got outside the moon was starting to rise. We alternated cameras as we had two Pentax's and a Miranda Laboreo and took as many pictures as we could before the sun got too bright as it rose. I only loaded about 14 pictures in my camera and they were soon used up. Wishing I had loaded more, I ran down to the darkroom and reloaded about 18 more. We weren't wasting any time because we were racing with a cloud that was threatening us. I only got half of my second roll exposed as we got clouded out by a single band above the moon.

Later, we developed our films with good and bad results. The Pan-X film in Mr. Patterson's Pentax (ASA 32) turned out quite good, although, the film in the Miranda (SO-410, special high resolution film, ASA 160) was underexposed. Later, it was realised that SO-410 is a red sensitive film, and we were shooting at a yellowish-white moon, hence it underexposed. My first roll of Plus-X was mostly underexposed too, but my second roll had some good pictures.

If you plan to take pictures of it, I would suggest exposures ranging from about 1/60th second to 10 seconds for most standard films. Somewhere in this range you should get good pictures, depending on how high out of the atmosphere the moon is and the speed of your film along with other factors. Good luck in veiwing.

MOON LESS THAN 48 HOURS OLD FOR NEW MOON ON 29 FEBRUARY 17:25 CST, 1976

WANING PHASE 27 February '76

Sunrise — Sun at Sunrise R.A. = $22^h\ 39^m\ 32.^s35$; Dec. = $-08^\circ\ 31'\ 44.''20$

07:59 CST — Moon at Sunrise R.A. = $20^h\ 48^m\ 32.^s84$; Dec. = $-12^\circ\ 36'\ 26.''56$

13:59 UT — Difference R.A. = $01^h\ 50^m\ 59.^s51$; Dec. = $04^\circ\ 04'\ 42.''36$

Angle between Sun & Moon = $28.^\circ05$

Sidereal Time at Sunrise = $17^h\ 15^m\ 57^s$

Moonrise — Sun at Moonrise R.A. = $22^h\ 38^m\ 49.^s51$; Dec. = $-08^\circ\ 33'\ 05.''77$

06:33 CST — Moon @ Moonrise R.A. = $20^h\ 45^m\ 34.^s80$; Dec. = $-12^\circ\ 46'\ 38.''47$

12:33 UT — Difference R.A. = $01^h\ 53^m\ 14.^s71$; Dec. = $04^\circ\ 13'\ 33.''30$

Angle between Sun & Moon = $28.^\circ63$

Sideral Time at Moonrise = $15^h\ 49^m\ 57^s$

dT = Sunrise − Moonrise = 07:59 − 06:33 = $1^h\ 26^m$

Age of Moon at Sunrise = $36^h\ 34^m$

Age of Moon at Moonrise = $35^h\ 08^m$

Altitude of Moon from Horizon ≠ $16.^\circ5$

* *

WAXING PHASE 1 March '76

Sunset — Sun at Sunset R.A. = $22^h\ 51^m\ 56.^s27$; Dec. = $-07^\circ\ 13'\ 51.''42$

18:47 CST — Moon at Sunset R.A. = $23^h\ 20^m\ 55.^s03$; Dec. = $+00^\circ\ 56'\ 19.''89$

00:47 UT — Difference R.A. = $00^h\ 28^m\ 58.^s76$; Dec. = $08^\circ\ 10'\ 11.''31$

Angle between Sun & Moon = $10.^\circ59$

Sidereal Time at Sunset = $16^h\ 01^m\ 48^s$

Moonset — Sun at Moonset R.A. = $22^h\ 52^m\ 11.^s76$; Dec. = $-07^\circ\ 13'\ 24.''27$

19:58 CST — Moon at Moonset R.A. = $23^h\ 31^m\ 07.^s97$; Dec. = $+01^\circ\ 08'\ 29.''39$

01:58 UT — Difference R.A. = $00^h\ 38^m\ 56.^s21$; Dec. = $08^\circ\ 21'\ 53.''66$

Angle between Sun at Moon = $9.^\circ74$

Sidereal Time at Moonset = $17^h\ 12^m\ 48^s$

dT = Sunset − Moonset = 19:58 − 18:47 = $1^h\ 11^m$

Age of Moon at Sunset = $25^h\ 22^m$

Age of Moon at Moonset = $26^h\ 33^m$

Altitude of Moon above Horizon at Sunset ≈ 16°

MINUTES OF A GENERAL MEETING, SASKATOON CENTRE, RASC,

HELD IN ROOM B-110, HEALTH SCIENCES BUILDING, 8:00 pm, 20 JAN., 1976

Present:

Halyna Kornuta.......... President
Mr Jim Young............ Vice President
Mr Gordon Patterson..... Centre Rep.
Mr Merlyn Melby......... Activities
Lillia Wilcox..... Secretary
Greg Towstego..... Editor
Mr Hugh Hunter.... Librarian
Doug Beck......... Sub-Councillor

Absent:

Mr Alan Blackwell...... Treasurer

Minute	Subject	Action
43.	Meeting called to order at 8:00 pm.	H. Kornuta
44.	Moved that December minutes be adopted as published.	G. Patterson J. Young
45.	No reply has been received from Edmonton Centre regarding the proposed exchange of speakers.	H. Kornuta
46.	The "Graphic Timetable of the Heavens" charts from "Sky & Telescope" were discussed. Several will be ordered for sale to members.	H. Kornuta
47.	Dr Skinner then gave an interesting illustrated talk on "Neutron Stars and White Dwarfs."	
48.	Jim Young presented Gordon Patterson a 10 X 60 University Optics spotting scope on behalf of the Centre in appreciation for his many contributions to the Centre over the past 6 years.	
49.	Meeting adjourned to Observatory at 9:15 pm.	H. Hunter, D. Beck

Minutes prepared by Lillia Wilcox ...
(Lillia Wilcox, Secretary)

THE ROYAL ASTRONOMICAL SOCIETY 1968
SASKATOON CENTRE

MEETING NOTICE

Place Rm 110, Health Sciences Bldg. U of S

Date Tuesday, 17 February 1976

Time 8:00 pm

Purpose February General Meeting

Dr. B.W. Currie speaking on "Solar-Terrestial Relationships and Climate"

Observatory Library

MINUTES OF AN EXECUTIVE MEETING, SASKATOON CENTRE, RASC,

HELD IN ROOM B-110, HEALTH SCIENCES BUILDING, 9:15 PM, 20 JAN., 1976

Present:

Halyna Kornuta.......... President
Mr Jim Young........... Vice President
Mr Gordon Patterson..... Centre Rep.
Mr Merlyn Melby......... Activities
Lillia Wilcox...... Secretary
Greg Towstego...... Editor
Hugh Hunter........ Librarian
Doug Beck.......... Sub-Councillor

Absent:

Mr Alan Blackwell...... Treasurer

Minute	Subject	Action
50.	Meeting called to order at 9:15 pm.	H. Kornuta
51.	A letter will be sent to the National Office concerning the new Society Crest Stamp Pad.	L. Wilcox
52.	The University Observatory will be closed in April due to dome replacement or repairs.	G. Patterson
53.	Meeting adjourned to Observatory at 9:30 pm.	J. Young, G. Patterson

Minutes prepared by Lillia Wilcox
(Lillia Wilcox, Secretary)

MINUTES OF AN EXECUTIVE MEETING, SASKATOON CENTRE, RASC,

HELD AT MR G. N. PATTERSON'S RESIDENCE, 79 BALDWIN CRES, 9:10 pm, 24 JAN, 1976

Present:

Halyna Kornuta.......... President
Jim Young............... Vice President
Mr Gordon Patterson..... Centre Rep.
Mr Merlyn Melby......... Activities
Lillia Wilcox...... Secretary
Greg Towstego...... Editor
Doug Beck.......... Sub-Councillor

Absent:

Mr Alan Blackwell...... Treasurer
Hugh Hunter........ Librarian

Minute	Subject	Action
54.	Meeting called to order at 9:10 pm.	H. Kornuta
55	A letter from the Edmonton Centre regarding the speaker exchange was read. The matter was discussed in detail regarding activities and accomodation. A reply will be sent outlining our views on the matter.	H. Kornuta
56.	Meeting adjourned at 9:45 pm.	

Minutes prepared by Lillia Wilcox
(Lillia Wilcox, Secretary)

PHYSICS FOR FUN

LECTURE: 8:15 pm, Wednesday 11 February, 1976,
Room 107, Physics Building, U of S, Saskatoon

Dr. E. J. Ansaldo will give a lecture on APPLICATIONS OF PHYSICS IN ART AND ARCHAEOLOGY.

These programs are designed for the general public - free of charge