



MONTHLY NEWSLETTER

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

HALIFAX CENTRE

JANUARY 1962

Interest in astronomy is now growing very rapidly as people become more conscious of the position and status of the earth and man in the vastness of space. The ever present awe inspired by a view of the heavens on a clear night has been amplified by the highly publicized attempts of man to leave his earthly environs for a few hours to hurdle through the near space. To-day, through the publication of many popular books and the mass media of the press, television and radio the general public have been offered a basic training in astronomy. Such training often awakes new interests within our questioning minds. The overall raison d'être of our society should be to aid each other in the active pursuit of our common interest and to make some contribution towards furthering mans knowledge of the universe

The Halifax Centre is particularly fortunate in having the facilities of the Nova Scotia Museum of Science at its disposal. The Museum kindly provide us not only with a meeting place but also with the use of one of the few planetaria in Canada.

It is greatly to our Centre's advantage to have the council and inspiration of a professional astronomer, the Reverend Father Berke-Gaffney, S.J., of St. Mary's University, who is our honorary president.

Under the new co-ordinated program set up by the national headquarters of our society **our observations**, even those made with cut optical aid, provide data which contributes to the **advancement** of astronomy.

The January meeting will see the beginning of a series of talks and planetarium demonstrations designed to improve our knowledge of astronomy. The Centre expects to **begin classes** in telescope making in the near future where members will be able to make their own instruments under the guidance of those members who have already ground their first lens.

The President.

AURORA GROUP: The following article entitled TUNING IN ON THE NORTHERN LIGHTS by Ian Bickle appeared in the December 1961 issue of the C-I-L Oval.

By studying chemical processes that take place miles above us, scientists obtain vital information about the upper atmosphere. One of the centres of this activity is the Institute of Upper Atmospheric Physics at the University of Saskatchewan.

Scientists there are particularly interested in the aurora borealis or Northern Lights - those beautiful displays characteristic of the Canadian skies. The aurora results when solar particles somehow find their way into the earth's atmosphere. Unpleasant effects are also produced by the same solar particles. These include the great magnetic and ionospheric storms that sometimes disrupt telegraphic and radio communications for hours and even days. Auroral displays can also interfere with the radar detection of missiles.

Because of Canada's geographic position, she has the best land area anywhere in the world from which to study the aurora. The University of Saskatchewan is one of the few universities located within the region of most frequent occurrence. For this reason there has been a longstanding interest in auroral studies, started 30 years ago by Dr. B. W. Currie, now director of the Institute of Upper Atmospheric Physics.

At the Institute, much of the work is aimed at finding out how the solar particles get from the sun to the earth and cause the aurora and many other effects. One of the principal objectives is determination of the properties of the upper atmosphere.

Since the auroral process is extremely complex, many methods of observation and study are employed. On clear, dark nights it is possible to obtain useful information by simply watching displays. Cameras record them for studies of the frequency of occurrence, position and motion. Photometric and spectroscopic devices are used to examine the chemical processes that are associated with the aurora.

Chemical studies of the aurora are concerned with the low-energy radiation chemistry of the upper atmosphere. This is a subject which extends beyond the aurora, for there are other interesting chemical reactions which take place in the upper atmosphere above all latitudes of the earth; these involve the recombination of dissociated oxygen atoms.

This recombination can take place by way of a number of different reaction processes. Some of these result in atoms and molecules being excited to produce a permanent emission from the dark atmosphere. This is called the night airglow. The study of these weak emissions can give further information about their physical properties and about chemical processes taking place high above us.

One series of chemical reactions in the upper atmosphere produces a glow that can be studied with a spectrometer. Production of hydroxyl radicals gives rise to the glow. Further studies might involve ejecting a chemical into the atmosphere to destroy ozone. This might result in the hydroxyl emission intensity, and therefore the glow, increasing. The emission occurs with greatest intensity in the infrared region of the

spectrum, and if the human eye were only sensitive at longer wave lengths, this feeble night glow would be as bright as the strongest aurora.

At wave lengths between one and two microns the emission can be studied from the ground using spectrometers and interferometers with lead sulphide cell detectors. Beyond two microns, the observations must be made from high altitudes using balloon-borne equipment. In April 1960, instruments built by the Institute of Upper Atmospheric Physics were carried aloft by a balloon over Quebec.

University of Saskatchewan scientists have noticed an emission band in evening twilight that is not there in morning twilight. They are interested in the chemical reaction that excites this emission, and the reason it appears in the evening and not in the morning. They think the sight is probably due to a phosphorescence of oxygen molecules in the infrared light of the sun.

Techniques used by physical chemists in measuring the temperature of flames have been adopted so they may be of benefit in auroral study. By using a spectroscope to analyze the light given off by some of the particles that make up the aurora, the temperature of the air in the vicinity can be deduced.

In an attempt to find out what causes the aurora's colors, various chemicals are being ejected in the upper atmosphere as part of the program of the Canadian Armament Research and Development board. The first is nitric oxide, which reacts with oxygen atoms to produce an intense green glow.

Hydrocarbons also have been tried in attempts to create glow in the air. According to H. I. Schiff of the Department of Chemistry, McGill University, "It seems highly desirable to try to find chemicals which react with constituents in the aurora. What is needed for such experiments is a container of chemicals and a mechanical timer to release the material at the predetermined altitude. All observations would be made from the ground with standard equipment."

At the moment, radar and radio methods are both in use. When the particles ejected from the sun strike the earth's atmosphere, they produce clouds of ionization which can be detected and tracked by radar. A system installed at Prince Albert, Saskatchewan, by the Defence Research Board was designed specifically to carry out studies of auroral ionization, but was damaged by fire and is now being rebuilt.

It is also possible to use ordinary radio transmitters, located from 600 to 1000 miles away from the receiving stations. By analyzing the radio signals received, scientists can separate out the effects which are produced when the radio waves bounce off the clouds of auroral ionization.

Radio studies indicate that the ionization is distributed within an auroral display in a complicated fashion. "What is needed to improve our knowledge is to place instruments within the auroral display to measure the amount of ionization that exists there, and the way it changes from point to point," says Professor P. A. Forsyth, head of the physics department at the University of Western Ontario.

It's hoped to do this with a rocket experiment early in 1962.

Professor A. Kavadas and his assistants at Saskatoon are building three separate packages to be placed in the nose of a rocket that will be fired into an auroral display from Churchill, Manitoba. The packages will be flung away, and each will measure the amount of ionization it encounters and will radio this information to the ground.

"Recently," Dr. Forsyth has pointed out, "great emphasis has been placed upon upper atmospheric research and in particular on radio studies of aurora. Part of this emphasis is due to the fact that radar detection of ballistic missiles is complicated by the aurora. But the information gained is also of considerable economic importance in the development of better communications.

"Whatever we learn from now on will assist greatly the designers of space vehicles, and will be a necessity before any manned flight is attempted from here to another planet."

The General Instructions for the I.G.Y. Visual Auroral Program for Canada has the following to say regarding colour and the use of filters.

COLOUR: In most cases the aurora appears of a greenish colour and visual attempts to distinguish between various shades of green are of doubtful value and should not be attempted. However, a reddish or red-orange hue should always be recorded by writing the word "R.D" in the appropriate position on the sketch. If an auroral form is red all over, mark it "ALL R.D". Blue or violet grey should also be reported, if these colours seem marked.

USE OF FILTERS: Under difficult observing conditions, when the sky is illuminated by city lights, moonlight, or moonlit clouds, the use of filters will help to distinguish auroral luminosity from other forms of illumination. Three filters are used mounted together in a convenient holder. An efficient set consists of red (No. 25), green (No. 21 and No. NBX3095) or (No. 57 and No. 16) and blue (No. 47). Observe the sky through the three filters and compare its relative brightness as seen through each.

In General:

- (a) blue lighter than green
red some luminosity means scattered city lights
- (b) blue lighter than green
green much lighter than red means scattered moonlight
- (c) green much lighter than either
blue or red means aurora

Having detected an aurora by this means, hold the green filter close to the eye and examine the form of the auroral feature. A red feature in the aurora will show up best in the red filter.

A limited number of filters have been supplied by the IGY World Data Centre, Aurora Archive-Visual Observation, Cornell University, Ithaca, New York, for use by members of the GROUP and may be secured by writing:

Mr B. W. Allen,
419 Windsor Street, Apt. 6,
HALIFAX, Nova Scotia.

The last reported sighting of aurora, in the Halifax area, was on the evening of October 28/29, 1961.

MEMBERSHIP FEES: Would members who have not yet renewed their membership for the year 1961-62 please do so without delay, for Headquarters in Toronto drops from its mailing list for publication the names of those who are still in arrears after the third week of January. Dues are \$5.00 per annum, \$3.00 for full-time students. Please make cheque or money order payable to The Royal Astronomical Society of Canada, Halifax Centre, and send it to the Secretary-Treasurer. His name and address are:

Dr. R. L. Aikens,
42 Bellevue Avenue,
HALIFAX, N.S.

FIREBALL REPORTS: Meteors are small, solid celestial bodies which are invisible, except those that enter the earth's atmosphere and are heated to incandescence by impact of the air molecules. Then they appear momentarily as the streaks of light across the sky that have been known as shooting stars. Very bright meteors are termed "fireballs" and merit special attention, since they may be observed even casually over a wide area. All meteors of magnitude -2 or brighter can be considered in this class.

Accompanying this issue of GALAXY is a copy of INSTRUCTIONS FOR USE OF FIREBALL REPORT FORM and a copy of FIREBALL REPORT.

More FIREBALL REPORT forms are available for those who wish to take part in this Group. For information and extra forms please contact:

Mr John D. Connelly,
6026 South Street,
HALIFAX, N.S.

Please forward all completed reports to Mr Connelly at the above address who will forward them to the National Research Council, Ottawa. In this way a complete record can be kept for this area.

GENERAL ASSEMBLY MEETING, EDMONTON, ALBERTA, MAY 18, 19 & 20, 1962: The General Assembly meeting of The Royal Astronomical Society of Canada will be held in Edmonton, Alberta, May 18 to 20, 1962. Attached to the October issue of GALAXY was a letter from Dr. Peter M. Millman, National President, concerning the event.

COMET AND NOVAE SECTION: Accompanying the October issue of GALAXY was Bulletin No. 1 from the Standing Committee on Observational Activities which listed the fields of activities and the National Co-ordinators for various sections. Heading the Comet and Novae Section was Mr. Jim Low of the Montreal Centre.

Attached to this issue of GALAXY is Bulletin No. 1 from the Comet and Novae Section, dated November 15, 1961, as published by Mr. Low, National Co-ordinator, Comet and Novae Section.

Mr. Bert Allen will head this section for the Halifax Centre and all correspondence concerning the Section should be directed to him at the address as given in the report on the Aurora Group.

We amateurs of the Halifax Centre have had little experience with finding and observing either comets or novae and the following, although basic in concept, will provide a basis on which to start work in this most interesting section of astronomy.

COMETS

Comets are perhaps the most remarkable objects in the solar system, their appearance differing greatly from what they really are.

In appearance, a bright comet is a large illuminated moonlike disk, often visible in broad daylight, followed by a tail hundreds of millions of miles long, moving like a planet about the sun, in a rather elongated ellipse.

But in reality, a comet is merely a globular aggregate of stones, which, upon approaching the sun, becomes warm enough to emit light and is converted partially into dust and gas that leave the comet to form the tail.

Each time a comet passes close to the sun, some of its mass is used to form the tail, the latter dissipating like smoke into space. After several score, or a hundred, perihelion passages, the comet exhausts all its volatile and incandescent material, becoming a swarm of meteorites roaming in space and supplying the earth intermittently with meteoric showers.

Comets differ greatly from all other objects in the solar system; they are quite unique in size, in mass, in density, and in behavior.

The length of a typical comet is approximately 100 million miles; and it may reach a length of 500,000,000 miles. The width and thickness of a comet are also of colossal proportions; 100,000 miles is a typical figure for either one of these dimensions.

Disproportionately, the mass is insignificantly small, too small to disturb the motion of even the smallest satellites on close encounter: the mass of a large comet is estimated at one millionth that of our earth.

Large volume and small mass make for very low mean density - probably not more than a millionth that of air at sea level. (Comets have been described as "the nearest thing to nothing that anything can be and still be something.") This low density is one reason that it is semi-

transparent, so that stars can be observed through them.

Notwithstanding the low density and the minuteness of its mass, a comet, when visible, is an imposing object. It may rival the brightness of Venus; it may stretch across half the sky from zenith to the horizon.

The vast dimensions of some comets, together with their remarkable brilliance, are no doubt responsible for the many superstitions historically associated with their appearances. The appearance of a bright comet was believed to be "ominous of the wrath of Heaven, and harbingers of war and famine, of the dethronement of monarchs, and the dissolution of empires." Myth is further provoked by their characteristic sudden appearances.

Actually, very few bright comets have been recorded: one in a lifetime is the average. The last great comet appeared in 1882, was observable for nearly nine months, and was conspicuous for several weeks. No truly spectacular comet has appeared in the present century. Two that appeared in 1910 (one, a return of Halley's Comet; the other, the 1910 I Comet), and the far southern comet of December, 1947, were only "fairly" great comets.

The frequency of faint comets is, of course, much greater than that of great or "fairly" great ones.

About eight new comets are discovered every year, most of them too faint to be seen by the unaided eye.

There are approximately a thousand known comets.

Comets are known by the name of their discoverer (e.g., Donati's Comet) or by the name of the astronomer who made the comet an object of scientific attention (e.g., Halley's Comet).

Now they are usually designated by the year of their first observed passage near the sun, together with a Roman numeral to indicate the order in that year (e.g., Comet 1910 I, or Comet 1882 III. Donati's Comet is also known as 1858VI.)

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

COMET AND NOVA SECTION

Bulletin No. 1

November 15, 1961.

As you may know, The Royal Astronomical Society of Canada is starting a national observing programme in an effort to bring the different Centres in closer touch with each other, and to try to centralize observational reports. Co-ordinators have been selected for different fields of work and I am in charge of the Comet and Nova Section.

The exact procedure used in the Comet and Nova programme will be sent to your Centre later, but in general this programme would include the systematic search for and observation of comets and novae. What I would like to know from you is - has your Centre done any work on Comets and Novae, and if not, would it be interested in taking part? If the Centre has been doing work in this field, please let me know what methods of observing and reporting are used.

Perhaps you could let the members of your Centre know about this programme. Tell them there is always a chance of gaining fame by discovering a comet or novae, and that if there is a large number of observers across Canada, the chances are that a few must make discoveries.

To prevent too many people corresponding directly with me, would your Centre please appoint one person to take charge of comets and novae there. All reports should be given to him for forwarding to me.

I hope your Centre will be interested in this type of observation and that I will hear from you soon.

Jim Low,
National Co-ordinator,
Comet and Novae Section,
411 Brixton Avenue,
St. Lambert, P.Q.

FIREBALL REPORT

YEAR MONTH DAY

HOUR MINUTE TIME ZONE

am
pm

OBSERVER

WEATHER

ADDRESS

LOCATION
OF
OBSERVER
WHEN
FIREBALL
SEEN

BURSTS

LUMINOSITY

COLOUR

FORM

DURATION

SOUNDS

POSITION
IN SKY

BEGIN

END

ELEVATION

BEARING

DATE

RELIABILITY

PLACE

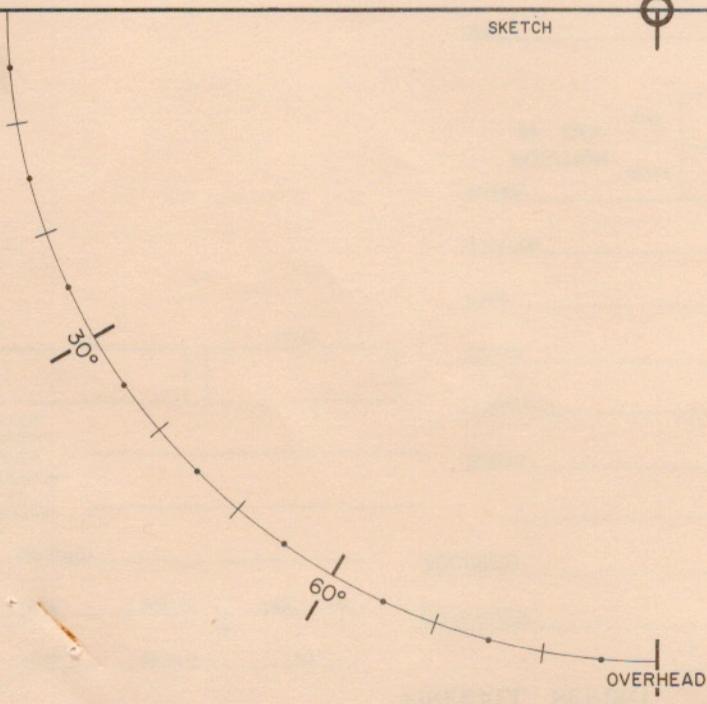
REPORTER

LAT

LONG

SKETCH

HERE



SIGHT ALONG THIS EDGE



MAIL TO: METEOR CENTRE,
NATIONAL RESEARCH COUNCIL
OTTAWA 2, ONTARIO.

INSTRUCTIONS FOR USE OF FIREBALL REPORT FORM

INTRODUCTION

These instructions are to be used for filling out the Fireball Report, ACM-1. A fireball is a bright meteor with a luminosity which equals or exceeds that of the brightest planets.

When a sufficient number of fireball observations are obtained over an area 100 miles or more in extent it becomes possible to combine the observations, and to predict the most probably area in which meteorites associated with the fireball may have reached the surface of the earth. Since freshly fallen meteorites are of considerably more interest than old falls, it is emphasized that the Fireball Report should be completed and mailed to the national headquarters as soon as possible.

FRONT SIDE OF REPORT FORM

Note that the entries are to be made on the line immediately above the word which appears on the card.

YEAR, MONTH, DAY.

On the top line enter the year, month and day of the observation. Remember that the date changes at local midnight.

HOUR, MINUTE, TIME ZONE

Enter the time of the observation indicating whether "am" or "pm" by crossing out the one which does not apply. Enter the correct time zone such as PST for Pacific Standard Time or EDT for Eastern Daylight Time,

being careful to indicate daylight saving time, as in the second example, when this applies. If possible indicate the accuracy of the time recorded.

WEATHER

Make a brief comment on the condition of the sky at the time of the observation, such as clear, cloudy, haze, etc.

LOCATION OF OBSERVER WHEN FIREBALL SEEN.

Enter a precise description of the observer's location. This may be given as section, township and range, or with reference to roads, rivers, lakes, buildings, or any other suitable landmark.

LAT LONG

This space is intended for an accurate entry of the latitude and longitude of the point of observation, and will in general be entered at headquarters.

OBSERVER ADDRESS

Enter here the full name of the observer and his normal mailing address. This is for use in correspondence, and need have no connection with his location when the fireball was seen.

BURSTS

If bursts or flares were observed during the passage of the fireball describe briefly the nature of these events, the number of bursts observed, and their approximate positions along the path.

LUMINOSITY

Make an estimate of the brightness of the fireball by comparing it with the brighter planets such as Venus or Jupiter or, for brighter fireballs, with the quarter moon or full moon. If nearby objects were observed to cast shadows due to the fireball this should also be noted.

COLOUR

Describe any noticeable colour or colour variation observed along the fireball path. Distinguish between colour observed while the fireball was in motion, and the colour of any persistent train which may have been visible in the sky for several seconds or even minutes after the passage of the fireball.

FORM

If the fireball appeared to have a definite size, estimate its apparent size by comparison with the apparent size of the moon in the sky. Statements such as "five feet across" or "as big as a baseball" have no meaning. Comment on the shape, such as circular, or pear-shaped.

DURATION

Estimate the duration of the luminous phenomenon distinguishing between the time the fireball was seen in motion and the duration of any persistent train in the sky. If the observer can repeat his actions at the time of the fireball, such as walking from one place to another while the fireball remained visible, timing this procedure will be much more accurate than an uncontrolled estimate of the duration.

SOUNDS

Most meteorite falls are accompanied by loud sounds heard over areas approaching 100 miles in diameter. A description of the type of sound heard together with the time interval between seeing the fireball and hearing the sounds, often several minutes, can be of great value. Any sound heard while the fireball is still in flight should also be noted. Since sounds from the bottom of the trail often reach an observer before sounds from the higher portions, the direction of the fireball's motion should not be estimated from the apparent motion of the source of sound.

POSITION IN SKY

These four boxes are designed for use at headquarters in the reduction of the fireball data. The observer's estimate of the position of the fireball in the sky should be recorded either in the blank space at lower left or on the reverse side of the form.

One of the best ways of doing this is to plot the path of the fireball in relation to the stars. If this is not possible the observer should stand on the spot where he was when the fireball appeared and attempt to recall what he saw. Estimates of the direction in which the beginning and end of the fireball path were seen can be indicated in a small sketch, or recorded in relation to roads, buildings, magnetic compass bearings, etc. Indicate approximate north on any sketch. A road map is of great assistance. Estimates of the elevation of the fireball path above the horizontal should be made using the protractor scale on the back of the form.

DATE

Record the date on which the card was filled out.

PLACE

Record the place where the card was filled out. If this was at the spot from which the fireball was seen, much the best plan when possible, place a check mark in the small box.

RELIABILITY

If the card is filled out as the result of an interview the interviewer may comment here on his impressions of the general reliability of the observation. If the card is filled out by the observer himself he may wish to indicate the limitations of his observation.

REPORTER

This space is for the signature of the interviewer, if the report is based on an interview, otherwise for the observer.

REVERSE SIDE OF REPORT FORM

The reverse side of the form consists of a simple device for determining the elevation of points above the horizon. The card should be clipped to a firm surface, such as a small board, and a string with a small weight at one end should be fastened to a pin or nail at the intersection of the two heavy lines (inside the small circle). The

string must be free to swing about this point. With the card held in a vertical plane sight along the edge near the arrow to the point in the sky to be measured, for example the beginning or the end point of the trail. Let the string come to rest, then hold it against the card without slipping and mark the position on the scale. Be sure to label this point as beginning or end of the trail, and repeat for the other point or points as required.

Additional comments or sketches may be put on the back of the form. The boxes at the upper right corner are for headquarters use only. If additional space is needed use a second form.

Mail the completed form to the address indicated.

No postage is necessary if mailed in Canada to: Meteor Centre,
National Research Council,
OTTAWA 2.