

Canada



613 Dickerson Ave.
Ottawa Ont.,
Canada K1V 1J2
March 14, 1986

Concord High School,
Concord New Hampshire,
U S A

Dear Mr Charles Foley - Principal

I did this project on Halley's Comet for my school, Fielding Drive Public School and for a Science Fair for the Ottawa Board of Education.

Please accept this project for your students in memory of Christa McAuliffe and the other six astronauts who died on Jan, 28, 1986.

In Canada, we have seen Halley's Comet and enjoyed it. For us, it is now history, because it went behind the Sun on February 9, 1986. For the U.S.A it should be quite exciting, as it comes out from behind the Sun tomorrow, March 15th 1986.

I hope the students can use some of its information to help them understand, see, and enjoy Halley's Comet.

Sincerely

Jennifer
Barrowman



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Principal
Concord High School
Concord, New Hampshire

03301



613 Dickinson Ave.
Ottawa Ontario
Canada K1V 7J2
March 14, 1986

re: Halley's Comet
Dear NASA

This is part of my project I did for my school, Fielding Drive Public School and for the Ottawa Board of Education's first City-Wide Science Fair.

I would like to donate it to Concord High School in memory of Christa Mc Cariffe.

I have come from Canada to the United States for the first time, March 8th-15th 1986, with my mother and sister. One of the places we had to see was the Kennedy Space Center. I wanted to give this to someone here. I would like to request if possible could you pass it on to the Principal - Mr. Charles Foley - Concord High School - Concord New Hampshire.

If this is not possible could you please pass it on to the closest school in this area and also re address the envelope?

Sincerely
Jennifer
Barrowman
(age 12)

Jennifer Barrowman
613 Dickinson Ave,
Ottawa Ont.
CANADA

IVASA Public Relations Dept.

HALLEY'S COMET



OTTAWA

1985-86

March 14 1986

To the students in memory
of Christa Mc Auliffe

Jennifer Barrowman
Ottawa Ontario
Canada

March 14 1986

To the students in memory
of Christa McAuliffe

Jennifer Barrowman
Ottawa Ontario
Canada

1. Introduction	page 1
2. What are Comets?	page 1
3. Halley's Comet Month by Month	page 2
4. Maps for Finding Halley's Comet	page 4
5. What You Won't See	page 9
6. Binoculars and Telescopes	page 11
7. Photographing Halley's Comet	page 13
8. There's No Need to Worry	page 15
9. Special Events in Ottawa for Halley's Comet	page 15
10. An Astronomy Club in Ottawa	page 15
11. Books, Magazines, Star Charts	page 17

INTRODUCTION

1986 is an important year for astronomers, as it marks the return of Halley's Comet. Many people will certainly want to see the Comet, so we, The Royal Astronomical Society of Canada's Ottawa Centre, have prepared this booklet to aid such people. Hopefully you, the reader, will be one of those!

Halley's Comet is named after Edmond Halley, an Englishman who lived from 1656 until 1742. He did not discover the comet, but instead was the first to realise that a bright comet observed in 1682 was the same one seen 75 years earlier. He successfully predicted it would reappear in 1758, although he did not live long enough to see its return.

Astronomers regard Halley's Comet as being special mainly because it has such a long history. It's been seen for thousands of years and hasn't been missed on its last 29 returns. No other comet has been observed for so long. It also has been one of the brighter comets on record and although the 1986 return is not very favourable, it should still be an impressive sight under dark skies.

Many people think of comets as objects that flash through the sky, like meteors. In fact, comets move very slowly and remain visible for several months or even years. This booklet will help you select the best dates and times to observe Halley's Comet as well as telling you where to look in the sky. First, though, you might want to learn a little about what comets are. If not, feel free to skip the next section.

WHAT ARE COMETS?

Before we discuss how to observe Halley's Comet some background information on what comets are might be useful. All have several features in common, including a nucleus, a coma and a tail. The nucleus is the only solid part; it is composed of a mixture of ice, dust, rocks and frozen gases. It is sometimes referred to as a "dirty snowball". This nucleus is much smaller than you might think - no more than a few kilometres in diameter.

For most of a comet's life, the nucleus is all that exists. This is because comets move in very elongated orbits and spend most of the time far away from the sun, outside the orbit of the solar system's most distant planets. But about a dozen or so comets pass close to the sun every year. As they approach the sun, solar radiation heats the surface of the nucleus, melting the ice and releasing the gas and dust to form a halo around the solid core. This halo, called the coma, is far larger than the nucleus, sometimes as large as 100,000 kilometres across. The nucleus and coma are often jointly called the "head" of a comet.

As the comet gets closer to the sun, the thin "wind" of gas that streams from the sun, and solar radiation, pushes the gas and dust away from the head to form a tail. Sometimes separate gas and dust tails can be seen. People think of a comet's tail as following behind the head, but this is not always true. The tail always points away from the sun, so a comet travels tail first when it is moving away from the sun.

Astronomers believe there is a giant cloud of comets, called the "Oort Cloud", at the outer edge of the solar system. Even though there are estimated to be billions of comets here, their small size results in their total mass being much smaller than the earth's. There is debate over how comets were made - some astronomers think they were formed in the inner solar system and were moved by gravitational influence to their present location, while others think they originated in the Oort Cloud. In any case, comets are very old, having likely been formed at the time of the creation of the solar system.

While most comets have very elongated orbits and don't return to the inner solar system for thousands or even millions of years, certain other comets have more circular orbits and much shorter periods. In fact, one comet - Comet Encke - has a period of less than four years! The brightest and most famous of these "periodic comets", however, returns once every 76 years. It is, of course, Halley's Comet.

HALLEY'S COMET MONTH BY MONTH

Here is a short summary of what to watch for in the coming year, as Halley's Comet comes closer and gets brighter.

August, 1985: The Comet has just been spotted by amateur astronomers with advanced equipment. It has appeared from behind the sun, but very early in the morning sky. The Comet is quite faint, low in the east before sunrise. A 40 cm or larger telescope is required to see it.

September, 1985: Halley's Comet is steadily brightening, getting closer to the earth and sun. It is visible in medium sized telescopes which are owned by some amateur astronomers, 25 to 30 cm in diameter.

October, 1985: Smaller telescopes, 15 to 20 cm in diameter should now pick up the Comet. It is also more conveniently placed for viewing, being up by midnight towards the end of the month. Publicity for the coming of the Comet is on the increase.

November, 1985: Halley's Comet is finally bright enough to be spotted by most people. If you own binoculars, you should have no

trouble finding it using the maps in this booklet, provided you are in a dark sky outside the City. The appearance of the Comet is now like a faint, hazy patch of light, unlike a star. A faint tail may be detected in telescopes. If you are following the Comet at this point, notice how it changes its position in the sky against the background stars.

December, 1985: If you are lucky enough to get out into the country, you are in for a treat. Halley's Comet may actually become visible to the naked eye. Go out with your binoculars to help you first find it, and then try to spot it with your naked eye. Go out on one of those cold, crisp, clear December nights when there is no moon. Remember, moonlight will greatly diminish any view of the Comet. With the bright stars of Orion, the winter Milky Way, and a snowy field, look for a wisp of light near the spot shown on the star map.

January, 1986: By now, Halley's Comet should attain a more classical appearance. By the end of the month, it will have sprouted a tail. Notice how the tail is pointing away from the sun. Binoculars, as always, still improve the view. However, the Comet is approaching the sun, and will soon go behind it. By about January 25, Halley's Comet will no longer be visible in a dark sky.

February, 1986: It is doubtful that anyone will see Halley's Comet this month. But by the end of February, it may just sneak out again. It will now be in the morning sky, visible just before sunrise.

March, 1986: Once again, you have to be up just before dawn to catch the best view of Halley's Comet. The sky will brighten noticeably by 5:15 a.m. in the beginning of March, and by 4:15 a.m. by the end of March. It will be worthwhile to get up, though, because this is approaching the best that Halley's Comet will be. By about March 25, the view will be less spectacular, as a full moon will be lighting up the sky.

April, 1986: By about April 4, moonlight is no longer an interference. However, on the next night, Halley's Comet will barely get above the horizon as seen from Ottawa. Now you can see why people are travelling to the southern hemisphere to get an improved view. Within another day or so, not even the tail will be above the horizon, and the Comet will be lost from view for a while. By April 14 or 15, the Comet may be seen again, but this time in the evening sky. The best time will be a few hours after sunset when the Comet is due south and highest in the sky. For a few weeks, Halley's Comet will get higher and higher in the south, at a much more decent evening hour. However, the Comet is also on its way back to the outer solar system, and it is steadily fading.

May, 1986: Halley's Comet is no longer visible to the naked eye, but can still be followed in binoculars or telescopes. Astronomers are still observing it at every opportunity, although the Comet is now a fading memory for the general public.

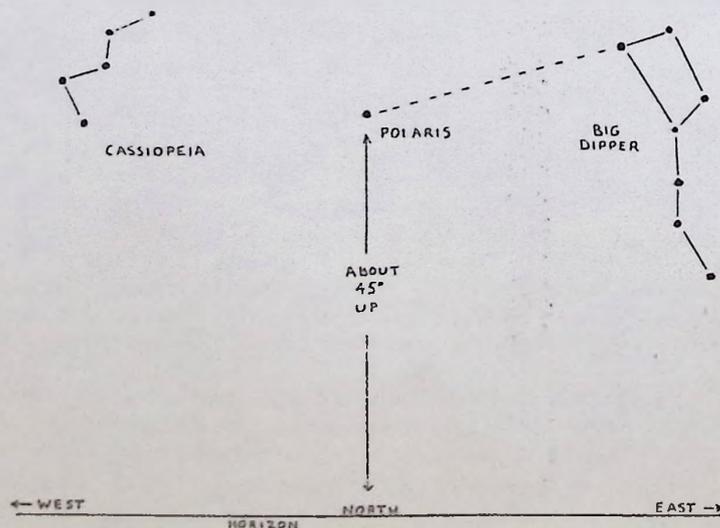
On the next several pages there are 4 star maps with the path of Halley's Comet plotted on them. The maps show the brighter stars, and near the path of Halley's Comet, there are fainter stars shown. (Map 1 is the exception; it shows fainter stars all over). In order to help identify star patterns, some of the constellations are named. The direction to Polaris (the north star) is shown to help get you oriented. You could also use a compass. The approximate horizon is shown, for various dates and times, as a wavy line. Notice how the horizon is different almost daily. This is due to the rotation of the earth, and its motion around the sun. Also, unless you are on the ocean, the horizon is not likely to be even as flat as is shown. You will probably have obstructions such as trees, hills or buildings. Naturally, these could make it difficult to spot the Comet when it is low in the sky.

When getting out to spot Halley's Comet, go to as dark a site as possible, preferably far from the City. Use a flashlight with a red filter when you look at the maps. This will help you to conserve your night vision. Use red plastic or red paper in front of the light.

Also shown on each map are a circle and a schematic tree. The circle represents the size of the field of view in the average 7 x 50 binoculars. The tree is about the size it would be if it was 10 metres high and 100 metres away. You will notice that the stars appear much larger on the maps than in the sky. In fact, all stars are tiny points of light to the eye, but of different brightnesses. This is represented on maps as dots of different sizes. Remember that this will throw off the apparent scale of the maps.

Getting Oriented

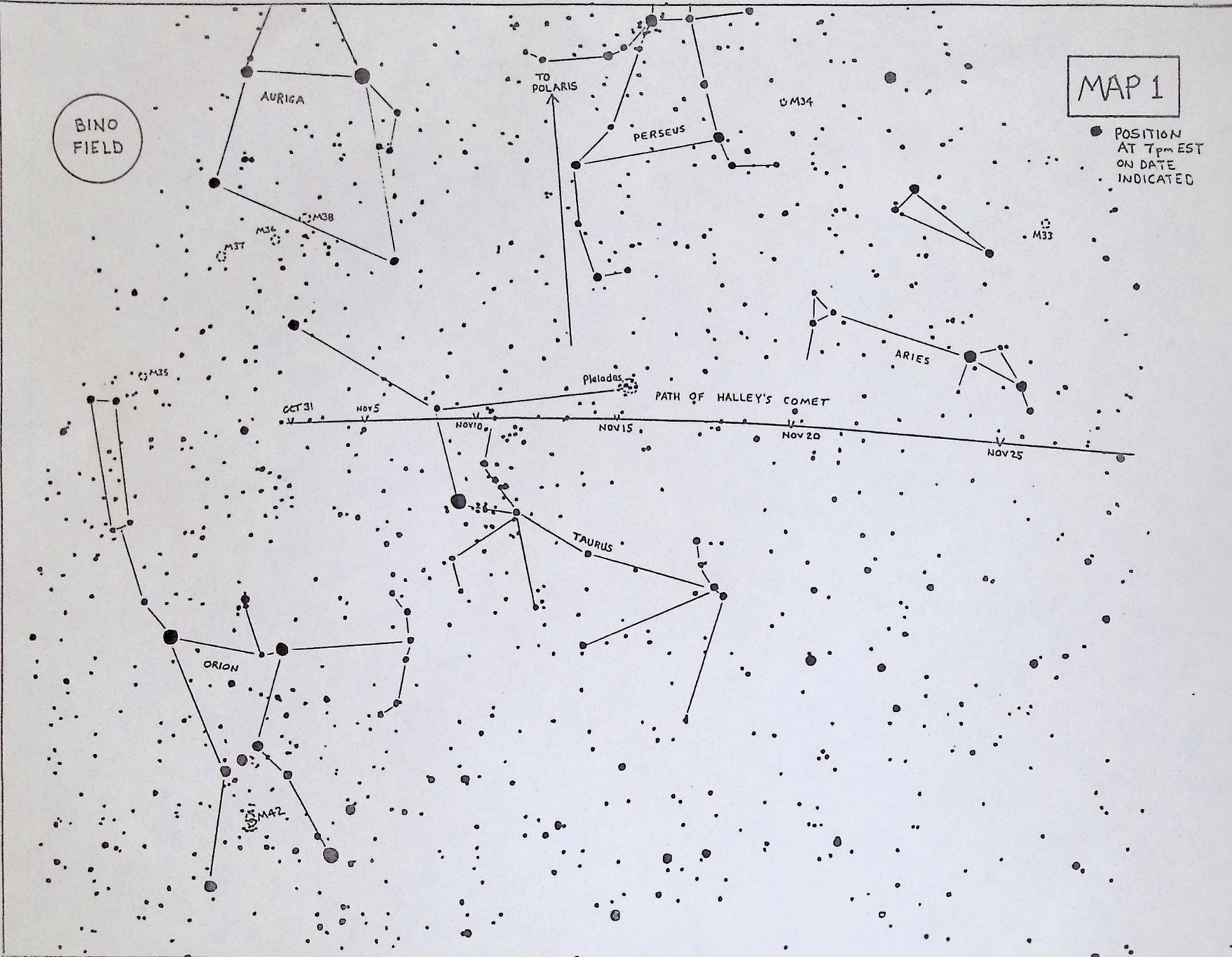
Below is a map showing how to find Polaris between the Big Dipper and the constellation Cassiopeia. The stars appear to move around Polaris, and therefore the orientation shown below is constantly changing. Try to discover, for instance, when the Big Dipper is on the left and Cassiopeia on the right. However, Polaris is always within 1 degree of true north, about 45 degrees up in the sky.



MAP 1

● POSITION AT 7pm EST ON DATE INDICATED

BINO FIELD



BINO
FIELD

MAP 2

POSITION AT
7pm EST ON DATE
INDICATED

ARIES

ANDROMEDA

TO
POLARIS

GREAT
SQUARE

PEGASUS

PISCES

NOV 28
NOV 30
PATH OF HALLEY'S COMET
DEC 5

DEC 10

DEC 15

DEC 20

DEC 25

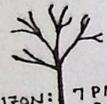
DEC 30

AQUARIUS

NGC 253

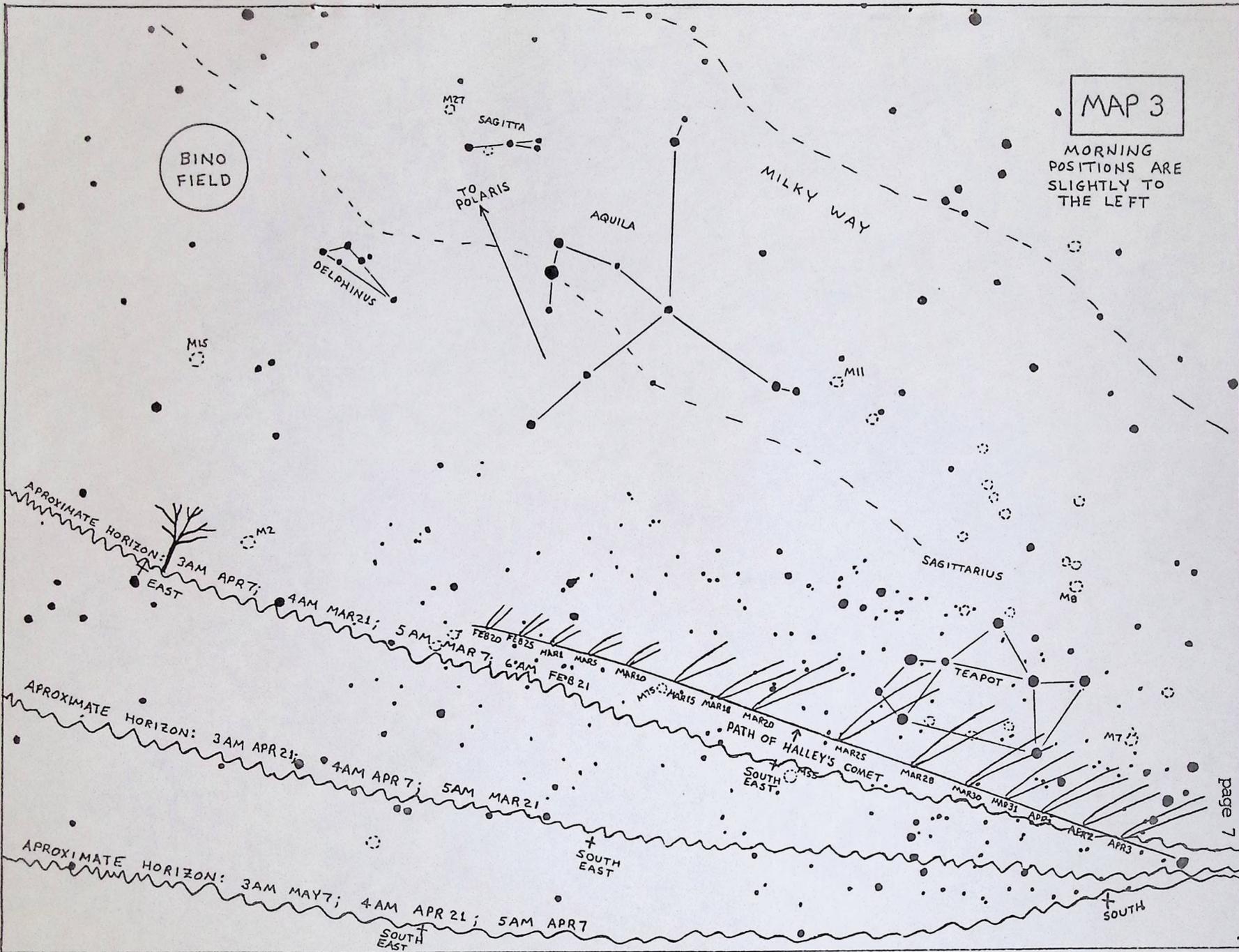
APPROXIMATE HORIZON: 7 PM FEB 7; 8 PM JAN 21; 9 PM JAN 7; 10 PM DEC 21; 11 PM DEC 7 ETC
SOUTH WEST

APPROXIMATE HORIZON: 7 PM JAN 21; 8 PM JAN 7; 9 PM DEC 21; 10 PM DEC 7; 11 PM NOV 21; ETC
SOUTH WEST



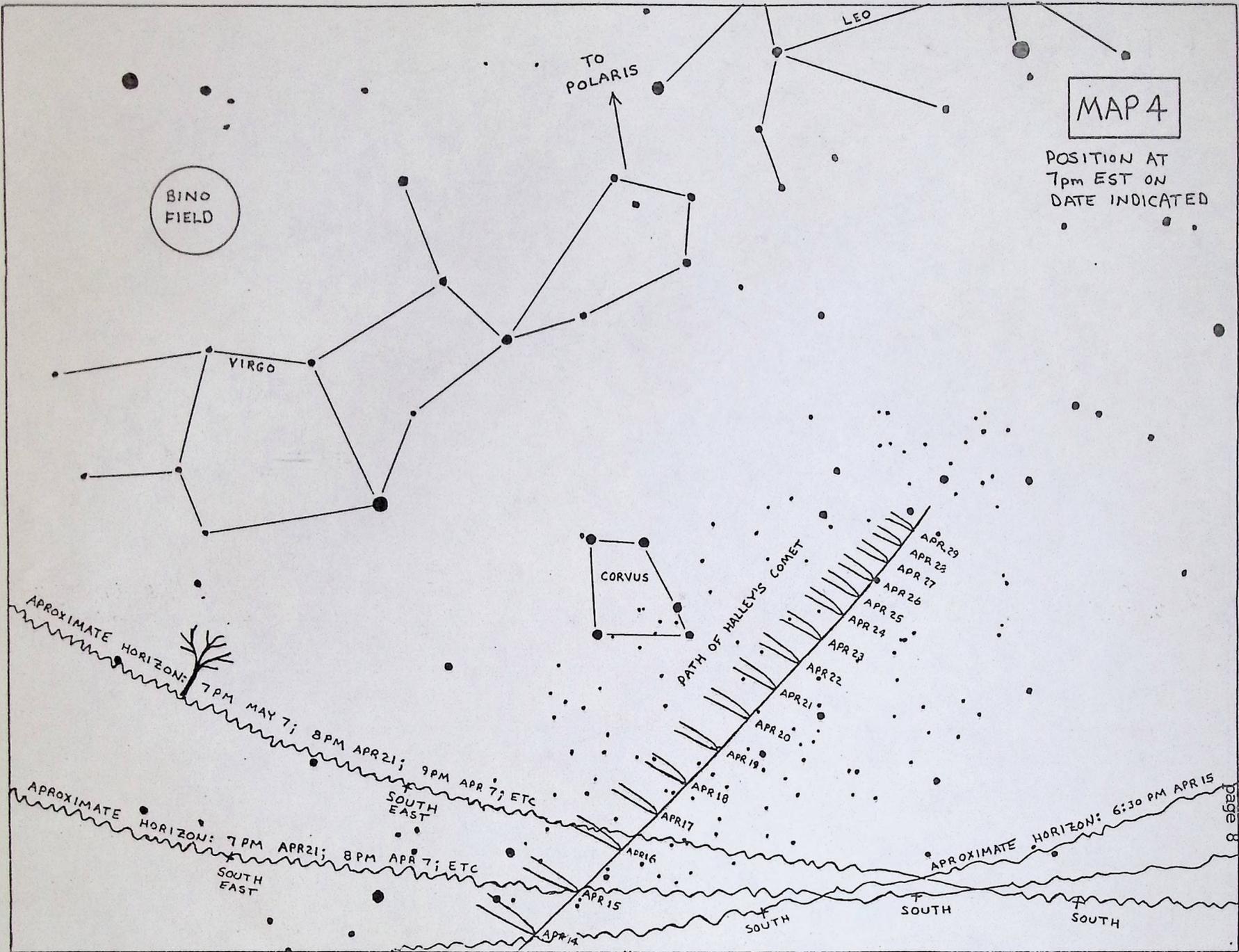
MAP 3

MORNING
POSITIONS ARE
SLIGHTLY TO
THE LEFT



MAP 4

POSITION AT
7pm EST ON
DATE INDICATED



MAP 1

This map shows the path of Halley's Comet during November. Look in the southeast in the late evening. Find the bright constellation Orion easily; it is the most prominent in the sky. Follow the star patterns to lead you to the location of Halley's Comet for a particular night. For dates not indicated, estimate the position of the Comet between the dates that are marked. Most likely you will need binoculars to find it at this point. Watch for the Comet to approach the Pleiades around the 15th. Look out for the comet-like objects indicated by dotted circles such as M35, M38, or M42. These are "deep sky objects", which could be confused for comets by the uninitiated.

MAP 2

This map is for December and January. The Comet will be in the evening sky during this period, well up in the south in December, but getting close to the western horizon after sunset by the end of January.

MAP 3

Start to look for Halley's Comet using this map in the beginning of March in the early morning. It's a whole new sky! Note the abundance of deep sky objects in the Milky Way. If we are lucky and Halley's Comet is bright, you won't even need a map for much of this period, which goes to the beginning of April.

MAP 4

This last map shows the Comet reappearing in the evening sky in the latter half of April. As the Comet is steadily growing small and dim, the map will be increasingly necessary. Try to follow the Comet as long as possible, and plot its position yourself for the month of May and beyond.

WHAT YOU WON'T SEE

What people are going to see when look for Halley's Comet will depend on what they expect to see. If you are expecting a spectacular bright streak moving across the sky, you are sure to be disappointed. Likewise, if you follow all the instructions for finding Halley's Comet accurately, but do it from Parliament Hill, chances are you will see nothing.

A lot of things are different this time from the passages of Halley's Comet in the past. Take for instance, the great amount of electricity used for lighting our cities today. Even in 1910, during the last appearance of Halley's Comet, there was very little of what astronomers call "light pollution". This is a recent phenomenon, brought on by our increasing population, greater use of energy, and the lighting of roads. City lights not

only cause a glare in the observer's eye, but the lights actually create a glow all around cities. This is caused by the vast amount of light from street lamps being scattered by minute particles in the atmosphere. It is by far the greatest threat to astronomy today. The glow from large cities of a population of one million or more can be seen a hundred kilometres away. Within the City, the situation is hopeless. On even the clearest nights, only the brightest stars can be seen from downtown. There will be almost no hope of seeing a relatively dim object such as Halley's Comet from within City limits. The best way for residents of Ottawa to overcome this problem is to go outside the City, 30 km or more away, preferably to the south.

Another problem for this passage of Halley's Comet is the geometry this time. The angles and distances are all wrong. The key objects are the earth, the sun, Halley's Comet and the moon. The moon? Yes, the moon. While not as devastating as the sun in brightening the sky, the moon is also effective in wiping out fainter nighttime sights. Fainter stars and the Milky Way, for instance, are not seen on full moon nights. And wouldn't you know it, when all other conditions are best for Halley's Comet, the moon is full!

Let us briefly compare the geometry of the 1910 appearance of Halley's Comet with that of 1985/1986.

As you may have gathered by now, comets spend most of their time in deep space, far from the inner solar system where the earth resides. As a comet's orbit carries it closer to the sun, it brightens. It follows, quite naturally, that Halley's Comet will be brightest when closest to the sun. The name for this point in the comet's orbit is called perihelion. This being the case, how is this different from 1910?

The answer is the position of the earth at the time of the perihelion of Halley's Comet. The earth, too, has an orbit which carries it around the sun, but in an almost circular path. In 1910, when Halley's Comet reached perihelion, the earth was nice and close to the Comet. The earth was at a point in its orbit which resulted in it being near Halley's Comet as its perihelion. Not only was the Comet at its brightest, but it was very close to the earth, which made it appear even brighter and larger!

Unfortunately, this time around, the earth will be on the opposite side of the sun at the perihelion of Halley's Comet. The Comet will be lost in the glare of the sun at its brightest, and it will be far away.

For residents of Ottawa, a further handicap will prevent good views of Halley's Comet. This is due to our northerly latitude. You may have heard of expeditions to the southern hemisphere to get a good view of the Comet. This is because the Comet will be

high overhead south of the equator. As seen from Ottawa, Halley's Comet will scarcely be above the horizon at its best.

And now that you have been totally discouraged, is there any point in trying to see Halley's Comet from the Ottawa area? Yes! While not the brightest comet of recent times, Halley's Comet is certainly the most famous Comet in history. If you are reading this in 1985/1986, chances are that this is your only opportunity to see this phenomenon of the solar system. Halley's Comet only comes around every 76 years.

Because Halley's Comet has been so well observed throughout history, we can predict very well when it can be seen, and what it will look like. This is not the case with other comets. Usually a comet first appears unpredictably, and there is little opportunity to provide the public with advance information of where to look. But with Halley's Comet, we can say with certainty in what part of the sky to look. And we can tell you what to expect to see.

There's just one thing. Comets are unpredictable, even the ones we think we know the best. This means that Halley's Comet may well be brighter than some predictions. There may be unexpected outbursts of activity. This makes it worthwhile to try and observe it at any opportunity. You could be in for a great sight.

But remember, your best views are sure to be outside the City, in a dark country sky.

BINOCULARS AND TELESCOPES

Sooner or later, you will get the idea that a telescope will let you see Halley's Comet better. Before you spend your money on a fancy telescope, consider this. Most amateur astronomers spend as much time looking through their binoculars as through their telescopes. In fact, when Halley's Comet is at its best it will be too big to be seen whole in a high-power telescope. Binoculars, with their low power and wide field of view, will provide an excellent overall view of Halley's Comet. Binoculars are easy to carry around with you by hand, easy to point and light in weight. Much easier to use than a telescope for someone who has no experience with either. And the best news is that binoculars are much cheaper than a telescope. Even if you lost your interest in Astronomy (God forbid!) your binoculars will come in very handy for sporting events, bird watching, rock concerts, and whatever else you can imagine.

Let's see what makes good binoculars.

Binoculars are described by two numbers, such as 7 x 35. This means that the magnification of the binoculars is 7 times,

and that the diameter of the objective is 35 mm. Both numbers are important.

While some magnification is good, too much will make it hard to point the binoculars and find an object. Therefore, 7, or at most, 10 power is a good magnification. Any higher and the image will be unsteady if held by hand. The diameter of the objective tells you how much light the binoculars gather. For astronomical objects such as Halley's Comet, the bigger the objective the better. You want to increase the brightness of the object as much as possible.

In general, the best binoculars to get would be 7 x 50 (said "seven by fifty") or 10 x 50. Tell this to the binocular salesperson. Obtain a reputable brand, expecting to pay \$50.00 to \$100.00. Over \$200.00 and you are gaining very little in the 50 mm size range.

A telescope is a different matter. A small telescope costing less than \$200.00 is going to provide a very disappointing view of Halley's Comet. It will simply be too small. A telescope large enough to provide any improvement in view of Halley's Comet over binoculars is going to cost at least \$500.00.

It is for this reason that the purchase of a telescope is not recommended for someone just starting out with a casual interest in astronomy. You can spend a lot of money and still be disappointed.

But for those who want some background information on telescopes, just to get an idea of the capabilities of what is available, here we go.

The most popular telescope among amateur astronomers today is the C-8. It costs between \$1,500.00 and \$2,000.00, depending on the little accessories you can get for it. The "C" indicates Celestron, the manufacturer, and "8" is the diameter of the objective, 8 inches or 200 mm. (It is still measured in inches because Celestron is a U.S. manufacturer). Because they are a U.S. manufacturer, you can expect quite a long delivery date for this telescope.

As with binoculars, the objective diameter of the telescope is important, and in fact, is practically the only standard by which telescopes are measured. Magnification is hardly every talked about. This is because any magnification is possible with any telescope; magnification is merely a function of the eyepiece used at any given time. As with binoculars, lower powers are preferred for many reasons. The image is brighter, because the light is not spread out at low power. Objects are easier to find at low power, because the field of view is larger. The image is steadier, because the imperfections of the telescope mounting are

not amplified. And, by the way, there is a practical limit to magnification. Beyond a certain power, the image gets fuzzier, much like getting too close to a TV set. For views of Halley's Comet, most observers will use between 20 and 150 power.

The second most important consideration in a telescope is the mounting. The larger the telescope, the sturdier the mount which is required. Above all, a telescope mount must be steady. Low to the ground and massive are good indicators of a solid mounting.

Our intent is not to discourage you from buying a telescope if you really want one, but to make sure you look around very carefully. If possible, speak to someone who already has one and has used it. One final word on observing Halley's Comet in telescopes. Don't expect it to appear like it does in the photographs you may have seen, which were probably taken at observatories using the largest telescopes in the world. Instead, allow yourself time to study the image carefully, over a period of many minutes. Let your eyes get used to the dim image, and be prepared for the subtle outline of the Comet. It will first appear like a fuzzy blob, but given time and patience, faint details will show up.

PHOTOGRAPHING HALLEY'S COMET

This can be a really exciting project for you to carry out. You can make a permanent photographic record of your sighting of Halley's Comet, which you can look back on for many years in the future. One thing that the advance in technology over 1910 has brought us is tremendous improvements in films and cameras. It is feasible for almost anyone to get a photograph of Halley's Comet. Don't worry about needing a telescope. All you need is a camera, tripod and cable release. If you already have a telescope, but don't know how to use it for taking pictures, don't worry about it. It is very difficult to photograph celestial objects with a telescope. In the case of Halley's Comet, you will be able to obtain totally satisfactory pictures without a telescope. And now, here are the details.

Type of Camera and Lens

There is one requirement for the camera, and that is that the shutter must be held open for many seconds or minutes. This is called a "bulb" exposure and designated on your exposure setting by a "B". This makes most of those new "instant" cameras totally unsuitable. Likewise, most "compact" cameras, even the 35 mm compact variety, probably do not have this feature. On the other hand, an example of a good type of camera is a 35 mm SLR (single lens reflex). If you don't already have one, you probably know someone who does. A 35 mm SLR takes excellent pictures, so you may consider buying one anyway. An SLR is easily recognizable by its pyramid-shaped prism on top. Naturally, if you have an expensive large format camera, such as a Hasselblad, you are even better off.

The main requirement for the lens is that it be "fast". This means a low number for the focal ratio, the "f" number. A good number would be f/1.8 or f/1.4. An f/2.8 lens is almost as good. The focal length of the lens should be about 50 mm, although focal lengths of 28 mm to 80 mm might prove suitable. If the focal length is shorter, the image of Halley's Comet will be too small. If the focal length is too long (over 80 mm), the image will be blurred as the earth turns during the exposure.

Why should the lens be fast? Because the Comet will be faint, that's why. Even if it is easily seen in a dark sky, Halley's Comet is a faint object as far as film goes, and the film needs all the advantage it can get.

Films

You should have the message by now that Halley's Comet is dim. If you know about photography, you probably know that some films are better than others for low light levels. The higher the film's speed, given by an ISO rating, the better it will be for recording Halley's Comet in a short time. You should get a film with an ISO rating of 400 or greater. Examples of such films are Fujichrome 400 or 3M Color Slide 1000, both for colour slides, Kodak VR 1000 for colour prints, or Kodak TRI-X for black and white prints. By all means, experiment with other types of fast films. Film is cheap compared to this once-in-a-lifetime opportunity to photograph Halley's Comet.

Exposure

Even with fast films and fast lenses, exposure times for Halley's Comet will be many seconds. It is therefore important to solidly support your camera, such as on a tripod. To reduce the vibration caused by opening the shutter, use a cable release.

Go to as dark a site as possible. Carefully point the camera to the part of the sky where the Comet is. Use the maps to help you find it among the stars. Use the widest opening of the lens, such as f/1.8 or f/2.8. Make sure the lens is shielded from stray light coming from cars and street lights. Set the camera's exposure time to "B" for bulb, in the manual mode. Open the shutter for about 10 seconds. Advance the film and try another exposure of about 20 seconds. Try a few more pictures of 30 seconds, 1 minute, and 2 minutes. You are sure to see something when you get your film back.

By the way, it might be a good idea to take some ordinary daytime pictures on your roll of film. This is to let the processing lab know where to cut the film, and it will be your reassurance that the film has been processed correctly.

Don't be alarmed if the stars appear to have "trailed" in some of the longer exposures. This is caused by the rotation of the earth. It is usually compensated for by more complicated equatorial mountings with clock drives.

THERE'S NO NEED TO WORRY

Throughout the centuries many people would predict terrible things would happen whenever a comet appeared in the sky. Today we know a lot about comets but, unfortunately, there are still some people who believe such predictions.

You will probably hear predictions of doom for all of us with the appearance of Halley's Comet. Predictions of disasters with the next comet have been made for centuries. Every year, however, there are several comets that pass in the vicinity of the earth. Most of these comets are dim objects that do not get much attention so the prophets of doom do not know that they are passing by the earth. Halley's Comet though, will attract their attention and their predictions will begin.

For the rest of us that know better, we can get out and observe this historical comet as it travels by us millions of kilometres away in space. We are very fortunate to be living to see Halley's Comet as this is a once-in-a-lifetime occurrence.

SPECIAL EVENTS IN OTTAWA FOR HALLEY'S COMET

If you would like to learn more about Halley's Comet, the Ottawa Centre of the Royal Astronomical Society of Canada will host a talk by Dr. Ian Halliday of the Herzberg Institute of Astrophysics of the National Research Council. Dr. Halliday will present important information about this return of Halley's Comet and answer any questions you may have about it or comets in general.

We will all want to see Halley's Comet and you will have a chance at a public star night in mid-November presented by the Ottawa Centre of the R.A.S.C., as well as another one at the end of April in 1986. Members will have their telescopes set up so that you can observe this famous Comet. The dates, places and times of all these events will be announced in the news media.

AN ASTRONOMY CLUB IN OTTAWA

If you would like to learn more about astronomy, then you may want to join the Ottawa Centre of the Royal Astronomical Society of Canada. The Ottawa Centre has over 200 members and there are close to 3,000 members across Canada in 20 Centres of the R.A.S.C. The Observers' Group meets on the the first Friday of every month at the National Research Council, 100 Sussex Drive in Room 3001, starting at 8:00 p.m. and you do not have to be a member to attend these meetings. The Ottawa Centre also has an observatory with a 40 cm reflector telescope located near Almonte, Ontario.

Membership in the R.A.S.C. is \$20.00 per year for adults and \$12.50 for youths (under 18 years of age). The membership fee includes the Observer's Handbook, the Journal of the R.A.S.C. and National Newsletter published six times a year, and as a member of

the Ottawa Centre you would receive Astronotes, the newsletter of the Ottawa Centre available at each Observer's Group Meeting. You can contact the Ottawa Centre by writing to:

R.A.S.C., Ottawa Centre
P.O. Box 6617, Station J
Ottawa, Ontario
K2A 3Y7

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BOOKS, MAGAZINES, STAR CHARTS

The following list of magazines and books will provide more information about comets and astronomy in general. This reading material is intended for the beginner and, in some cases, for the advanced amateur astronomer.

Magazines

Astronomy Magazine, published monthly, available by subscription and sold at newsstands.

Sky and Telescope, published monthly, available by subscription, Sky Publishing Corporation, 49 Bay State Road, Cambridge, Mass. 02238.

Books

The Comet Book, A Guide for the Return of Halley's Comet, by Robert D. Chapman and John C. Brandt, 168 pages, Jones and Bartlett Publishers Inc.

Halley's Comet by Francis Reddy, published by Astronomy Magazine.

Comets: Vagabonds of Space by David A. Seargent, 234 pages.

Nightwatch, An Equinox Guide to Viewing the Universe by Terrence Dickinson, 159 pages, Camden House Publishers.

The Stars by H.A. Rey, 160 pages Houghton Mifflin Company, Boston.

The Observer's Handbook, published annually by the Royal Astronomical Society of Canada.

Star Charts

Wil Tirion Sky Atlas 2000.0, 26 star charts, covering both hemispheres showing stars to magnitude 8.1 and about 2,500 deep-sky objects.

Norton's Star Atlas showing naked eye stars in both hemispheres, Sky & Publishing Corp.