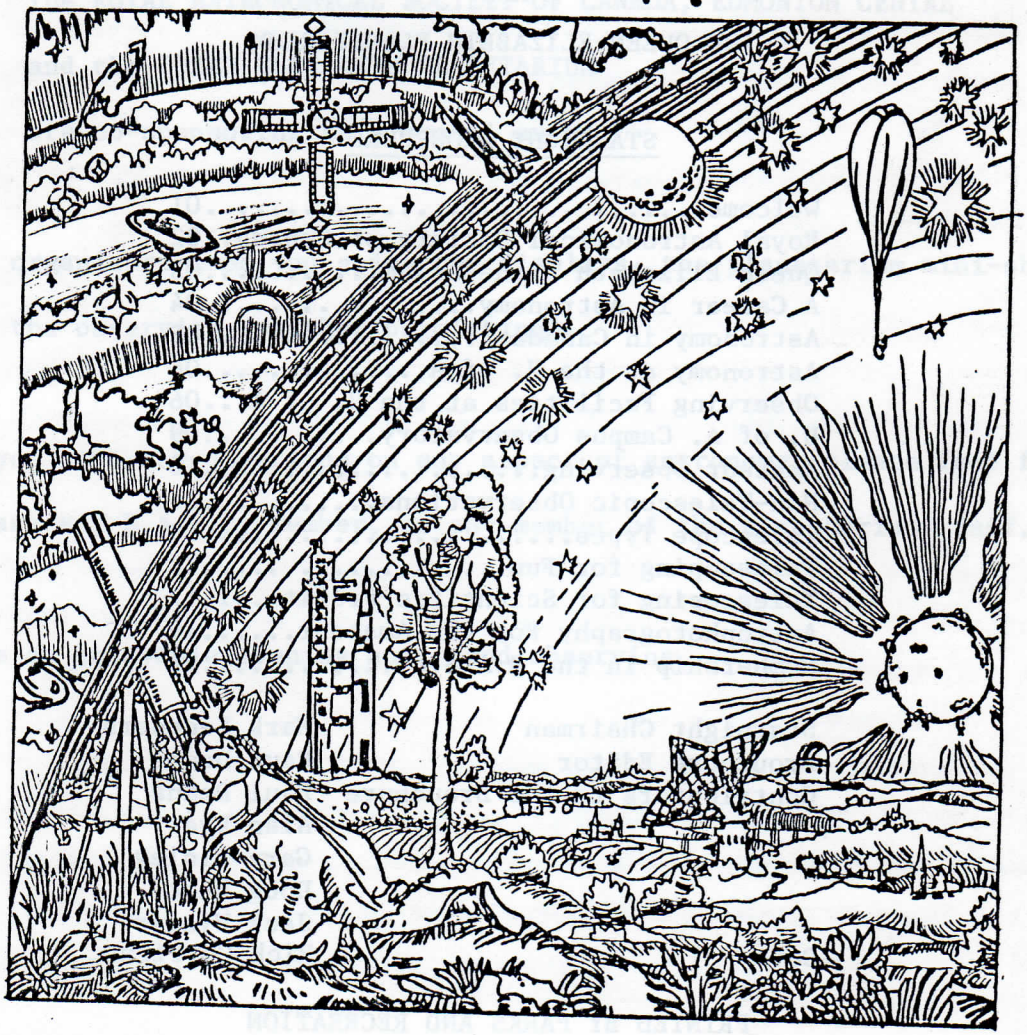
STAR NIGHT '78



STARNIGHT '78

HOSTED BY

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

EDMONTON CENTRE

AND

THE QUEEN ELIZABETH PLANETARIUM

STARNIGHT BROUCHURE

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CITY OF EDMONTON

WELCOME TO STARNIGHT '78

The ROYAL ASTRONOMICAL SOCIETY OF CANADA, EDMONTON CENTRE
and the QUEEN ELIZABETH PLANETARIUM
are co-sponsoring this annual event.

The organizers hope you enjoy the displays, the planetarium mini-shows and the observing (weather permitting).

If you have any questions on any aspect of astronomy, please feel free to ask any R.A.S.C. member, or any member of the planetarium staff.

Have an enjoyable evening and, good observing.

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

Anyone who is interested in one of the many facets of astronomy; whether it be star-gazing, telescope making, Astronomical or Space Science Theory, can find an opportunity for sharing and increasing those interests by becoming associated with the Royal Astronomical Society of Canada, Edmonton Centre. Membership in this centre entitles one to full privileges as members of the R.A.S.C., which has its National Headquarters in Toronto, Ontario, The R.A.S.C. includes both professionals and amateurs and has centres in major cities across Canada.

Meetings of the Centre are normally held on the second Monday of each month (from September to June inclusive), at 8:00 p.m., in the Queen Elizabeth Planetarium. These meetings feature a variety of guest speakers whose topics range from practical observational astronomy to theoretical discussions of exotic interstellar objects. In addition to these regular meetings, we organize each year an observing or information session or Starnight, several out-of-town observing sessions, and a banquet held in November. As well, each year an exchange speaker from the Calgary R.A.S.C. and the Vancouver R.A.S.C. present a talk.

Membership in the R.A.S.C. includes complementary admission to the Queen Elizabeth Planetarium. R.A.S.C. members also receive the annual R.A.S.C. Observer's Handbook; Stardust, the monthly bulletin of the Edmonton Centre and the Journal of the National R.A.S.C. published bi-monthly.

QUEEN ELIZABETH PLANETARIUM

The Queen Elizabeth Planetarium was built by the citizens of the City of Edmonton to commemorate the 1959 royal visit of Her Majesty Queen Elizabeth and Prince Philip.

Officially opened in October, 1960 the Planetarium became the first such facility in Canada devoted to the popularization of astronomy. Since that time hundreds of thousands of visitors have attended the Planetarium programmes making the unit an important part of Edmonton Parks and Recreation's Historical and Natural Science Services.

The heart of the Star Theatre is the "Star Projector". Manufactured by the Goto Optical Company of Tokyo, the "Venus" projects some 2,800 stars through thirty-two optical systems as well as projecting the Sun, Moon abd the five naked-eye planets of our Solar System.

With this incredibly complex instrument the audience may view the evening sky as seen from any point of the surface of the Earth while passing through any time sequence; as small as a minute or as large as an eon. Aided by a battery of 35 mm slide projectors, a panorama system and highly specialized effect projectors, the audience can be transported to anywhere in the solar system...and beyond. The entire visual experience is enhanced through the use of the finest sound system.

The Planetarium is in essence the ultimate form of Multi-Media Theatre. Each production is a dramatic blend of the astronomer's knowledge and the talents of writers, artists, and technicians. The end result is a programme which is not only educational but also entertaining, sometimes serious, sometimes amusing!

AN INTRODUCTION TO A CAREER IN ASTRONOMY

Astronomy, the oldest and one of the most rapidly changing sciences, encompasses the widest range of physical phenomena of any science. The research interests of astronomers range from interstellar space, to pulsars and black holes.

More classical fields of study are the structure and origin of the Earth and the Solar System, the Sun's place in the Milky Way Galaxy, physical and dynamical properties of stars and galaxies, and so on.

A successful career in Astronomy and Astrophysics requires a thorough education in the physical sciences. The increasing sophistication in methods of analysis, the study of more and more extreme physical conditions, and the increasingly complex picture of the Universe which is emerging, force the students of Astronomy to become especially familiar with advanced mathematical techniques and the use of computers.

Anyone planning to pursue a career in Astronomy is advised to major in Physics and/or Mathamatics during his undergraduate years at university. At his stage, one or two courses in introductory Astronomy and Astrophysics are adequate. More advanced training and specialization in a particular field of Astronomy will normally be reserved until the student is in graduate school.

Studies in Physics should include mechanics, heat, optics, (geometrical and physical), electricity and magnetism, thermodynamics, atomic physics, and an introduction to nuclear physics, geophysics and quantum mechanics. Studies in Mathematics will include trigonometry, analytical geometry, calculus, advanced algebra, some statistics and

numerical analysis and computer science. One or two courses in Chemistry and, possibly,Biophysics might be useful.

Most major Canadian universities offer undergraduate and/or graduate programs in Astronomy. For further information, write to the Guidance Centre, Faculty of Education, University of Toronto, 1000 Yonge Street, Toronto, Ontario M4W 2K8, and request a copy of the GC. Occupational Information Monograph entitled, Astronomer.

ASTRONOMY IN CANADA

At the present time over 150 persons are employed full-time as professional astronomers in Canada. Most Canadian universities have either a separate department of astronomy (Toronto, Western Ontario, University of British Columbia) or have one or more astronomers on staff in their departments of physics or mathematics (Alberta, Calgary, Victoria, Brandon, Queen's, St. Mary's etc.).

The largest optical telescope in Canada is the 188 centimeter (74 inch) diameter reflector of the David Dunlap Observatory north of Toronto. There are 183 and 122 centimeter telescopes near Vicotoria, a 122 centimeter near London Ontario, and many 60, 50 and 40 centimeter telescopes at other locations. A Canadian-owned 60 centimeter telescope is operated on Las Campanas, Chile. The largest Canadian radio telescope is 46 meters (150 feet) in diameter and located in Algonquin Park, Ontario. There is a 26 meter dish near Penticton B.C. Most of these telescopes are open to public view during restricted visiting hours.

Several years ago an agreement between Canada, France and Hawaii was signed announcing the construction of a 3.6 meter (141 inch diameter) telescope on Mauna Kea, Hawaii (elevation 4,185 meters). When completed

in late 1978 (at a cost of more than $20 million) this instrument will be one of the half dozen largest telescopes in the world, and will provide an important stimulus to the further development of Canadian astronomy.

ASTRONOMY AT THE UNIVERSITY OF ALBERTA

The Department of Physics offers several undergraduate courses in astronomy and astrophysics. Some are directed towards students majoring in a physical science, while others are basically survey courses of a descriptive nature and are available to students in other faculties such as Arts and Education.

Research and teaching in astronomy and astrophysics is conducted by members of the academic staff in the Department of Physics, (observational astronomy, theoretical astrophysics, laboratory astrophysics) and in the Department of Electrical Engineering (radio astronomy). Programs leading to undergraduate and graduate degrees are open to qualified students. A graduate program is available in Astronomy and Astrophysics leading to the M.Sc. and Ph.D. degree. Excellent computer and laboratory facilities exist. Observational facilities consist of a 30 centimeter (12 inch) telescope on campus for use by undergraduates and a 50 centimeter research telescope near Devon.

OBSERVING FACILITIES OF THE UNIVERSITY OF ALBERTA

History:

The Astrophysics Group of the Department of Physics at the University of Alberta has, for a number of years, operated a small observatory at a site some 5 kilometers north of the town of Devon. The main instrument has been a 30 centimeter Tinsley Cassegrain

reflector. This instrument proved to be unsatisfactory for serious astronomical research, and about two years ago the decision was made to construct a larger, research-grade instrument.

The size of the new telescope was dictated by limited funds, a limit to the size of work that could be done in University machine shops, and the fact that the finished telescope would have to fit into a dome of only four meters inside diameter. From a consideration of these constraints, it was decided that the optimum aperture was 50 centimeters.

Optical Design

The telescope is designed so that it can be used in any of three different optical configurations. It will be usable at the prime focus as a Schmidt-quality camera, at an F/8 Cassegrain or Naismyth focus, and at an F/18 Cassegrain or Naismyth focus.

The prime focus will be used exclusively for photographic work. In the present case, the correcting plate reduces the effective aperture to 43 centimeters.

The telescope can be converted into an F/8 Cassegrain of 4 meters focal length by replacing the prime focus corrector and camera by a convex secondary mirror. The F/8 focus is designed primarily for photographic use. The limiting magnitude should be fainter than +21 (about the same as the 122 centimeter Schmidt of Palomar Observatory). It is also possible to use the Naismyth focus (folded Cassegrain) by inserting a third flat mirror to deflect the light out the side of the tube. In this configuration, the telescope will be used for photometry, spectroscopy, or visual observing. The flat mirror can be rotated to any of three positions (photometer, spectrograph, eyepiece) in a matter of seconds, allowing very flexible observing programmes.

The telescope can be converted into an F/18 Cassegrain of 9.4 meter focal length by the substitution of a second convex secondary mirror. This focal ratio is selected primarily for photometric or spectroscopic use at the Naismyth focus. The F/18 can also be used for photography at the Cassegrain focus and a camera system has also been designed.

Mechanical Design:

This telescope is designed for the convenience of the observer, in that the Naismyth focus remains near the same position (about 1.5 meters from the floor and near the center of the dome) regardless of where the telescope is pointing in the sky. Hence the observer will not have to climb ladders in order to reach the eyepiece at odd positions. The finder, guide telescope, and offset guider will also be conveniently placed. There will be electric motor drives for both right ascension and declination setting, controlled from a single hand-paddle. Consideration is being given to the possibility of digital readouts and computer control. A sketch of how the finished telescope will appear is shown in figure 1.

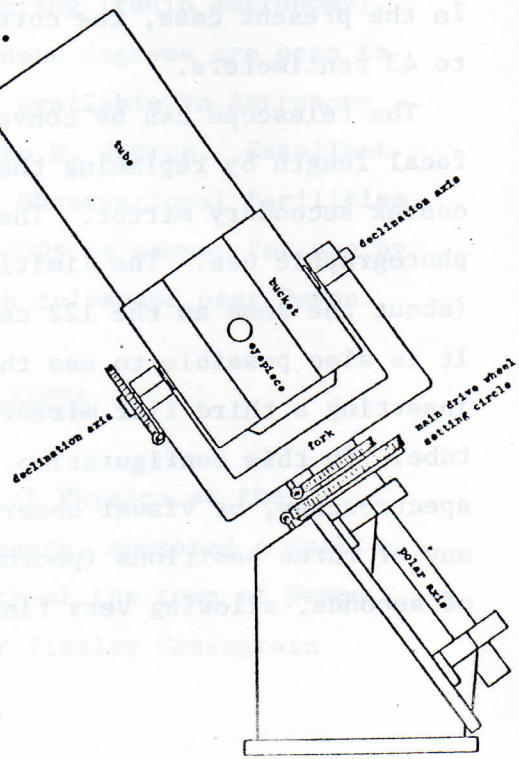


Figure 1:

Sketch of the 50 cm telescope

Telescope Status:

All mechanical aspects of the telescope construction are complete, with the exception of accessories such as dust caps. The tube and bracket are also complete. In addition, most of the electronics are in the final stages of installation (such as the power supply to all the drives. John Woolley is finishing the digital readouts for the telescope controls. The optics are in the final stages of figuring. The main mirror will soon be silvered, with the fine testing to commence soon after. During the summer and autumn, tests of the completed system will reveal how soon the telescope will be ready for full operation.

The Observatory:

A few changes have been made in the observatory at Devon to accommodate the new telescope. A new pier has been installed for the telescope. The floor has been raised by about 46 cm to allow more convenient access to the eyepiece of the new telescope. A small addition to the dome in the form of a 1.8 x 2.4 meter rectangular building has been built to serve as a storage area for the extra telescope tubes, and to serve as a control room for the telescope.

The 30 cm telescope that was at the Devon facility has been moved to the University campus, and is mounted on the south-west corner of the Physics building in a rectangular building with a roll-off roof. It is presently used for student instruction, and is open to the public (by reservation) every Friday night.

UNIVERSITY OF ALBERTA CAMPUS OBSERVATORY:

The Department of Physics, University of Alberta, operates a 30 cm telescope in an observatory on campus. The observatory is now open to the general public each Friday evening (holidays excepted). However, due to a lack of dark night skies at Edmonton's latitude during the summer,

the observatory will be closed between May and August inclusive.

Weather permitting, the telscope will be used for viewing various celestial objects which may include the Moon (normally available only one evening each month), Jupiter, Saturn, double stars, star clusters and gaseous nebulae. In the event of cloudy weather, a slide or film show will be presented.

There is no admission fee, but only a limited number of people can be accommodated each evening. Reservations must be made in advance. For individuals or small groups contact the Public Relations Office at 432-4201 during normal working hours.

Large groups only (Scouts, Guides, Schools, etc.) may be admitted at other mutually convenient times. Arrangements must be made well in advance by contacting Dr. D.P. Hube (432-5410).

AMATEUR OBSERVING

Perhaps one of the greatest disappointments ever faced by the beginning amateur astronomer is when he or she leaves behind their glossy 8 x 10 book (ops...of course I mean 20 cm x 25 cm book) of beautiful black & white and colour prints of planets, nebulae, star clusters and galaxies and ventures into the 'real' world of the observer. Gone are the intricate details and beautiful colours. In their place are quivering fuzzy blobs of white light that often bear no resemblence to the 20 x 25 glossy prints. However, if the initial shock can be overcome, the beginning observer will soon find much of beauty in the night sky that cannot be adequately portrayed in a book. The remainder of this STARNIGHT brouchure is designed to provide a few ideas to those who may be just starting the hobby of astronomy.

ASTRONOMY AND THE AMATEUR

NON-TELESCOPIC OBSERVATIONS: EYEBALLING IT

So you don't have even $100.00 to invest towards a telescope. Does this mean that astronomy is not for you? Definitely NOT! Nearly everyone has a reasonably decent pair of eyes, many people also have binoculars and a camera. Properly used, this equipment will give you a fairly good idea as to whether or not astronomy is for you.

The whole key to non-telescopic observing is to LOOK UP WHENEVER POSSIBLE. This seems to be simply stating the obvious, but it certainly can't be over-emphasized. Most people know the beauty of a sunrise or sunset, and many look for a rainbow after a storm, but there are other sights in the heavens that can be just as inspiring. Some are very infrequent, others may occur every night.

Eclipses of the Sun and Moon are rare, but spectacular sights. (During the morning hours of February 26, 1979, a partial solar eclipse will be visible from Edmonton. The 1979 solar eclipse will be total in Winnipeg, and surrounding areas).

Even more unreliable is the appearance of a bright comet, but Comet West, visible before sunrise early in 1976, proved to be an excellent naked eye/ binocular comet.

During the night, other events and objects present themselves to view. The changing face of the moon regularly enhances the night sky. A display of the aurora borealis may appear at any time. Every hour 5 or 6 meteors appear for a few brief moments, but on certain evenings up to 50 meteors per hour may stream from a particular region of the sky. (Two of the more intense meteor showers that occur each year are: Perseids - August 12, 50 meteors per hour; Geminids - December 12,

50 meteors per hour).

Acting as a backdrop to all this activity are the bright and faint stars that make up the various constellations. Knowing where these star groups are, their approximate shape, and where the brightest stars are located in each is not only of general interest but is useful when describing where various celestial events were seen. Certain constellations and bright stars can be employed as skymarks against which the positions and motions of the naked-eye planets can be plotted. The motions of the various planets are easy to see when they pass near a bright star or close to each other. The great speed of the moon also becomes apparent under similar circumstances.

This has been only a quick and incomplete series of ideas as to what can be seen with simple equipment. Many of the events described are also simple to capture on film. Watching these celstial events may help you decide whether or not you want to invest further time, effort and money in the subject.

NON-TELESCOPIC OBSERVATIONS: BINOCULAR ASTRONOMY

Many fine views of the heavens can be obtained without the aid of a telescope if a common pair of binoculars is available. A steadily supported pair of binoculars will show lunar craters and the moons of Jupiter, but there are other targets in the sky more suited to binocular observing.

In order to produce steady images while being hand-held, binoculars rarely magnify more than 7 to 10 times. This low magnification gives them a much wider field of view than any telescope can have, and allows them to produce extremely bright images of the objects they are pointed at. These characteristics make binoculars ideal for observing large

objects such as star clusters, large nebulae and comets. When astronomers are searching the skies for their first sighting of a newly reported comet, they almost always use binoculars (rather than a telescope) for this reason.

The purpose of any astronomical optical aid is to gather a large amount of starlight, so large binoculars with 50 mm objective lenses (i.e. 7 x 50 or 10 x 50) are better suited to astronomy than other types such as 7 x 35's or 8 x 30's. The large lenses of the 7 x 50's were designed for night reconnaissance work during the second world war, and the brilliant images they produce have made them a standard piece of apparatus for amateur astronomers all over the world.

A favorite pastime of many amateur astronomers is slowly sweeping through the band of the Milky Way on a dark moonless night with a pair of 7 x 50 binoculars. When this is done, hundreds of interesting star clusters and stellar groupings can be seen in a single night's observing, especially if an observing site outside of the city is available. Even more so than in other types of observing, success in binocular sweeping of the skies depends on having the darkest possible location to work from.

If you own a pair of binoculars or can afford one, why not give it a try? The spectacular summer Milky Way is awaiting you.

TELESCOPE TYPES

In all the world, there are only two basic types of optical telescopes -- reflectors and refractors. The refractor, illustrated in figure 2, resembles a spyglass with a lens at one end of a long sealed tube and an eyepiece at the other end. The light is bent or refracted by the objective lens so that it comes to a focus at the

Figure 2

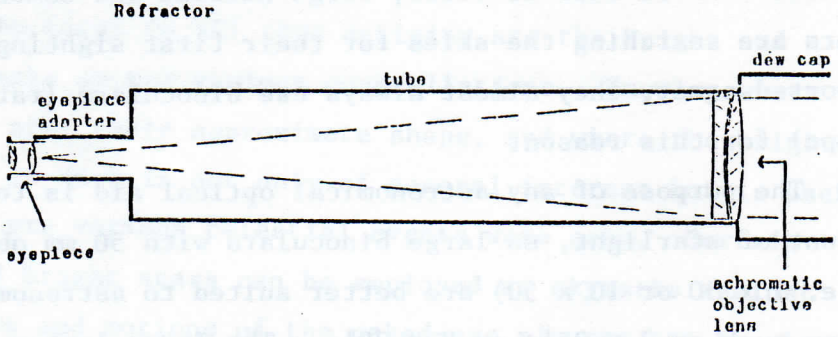
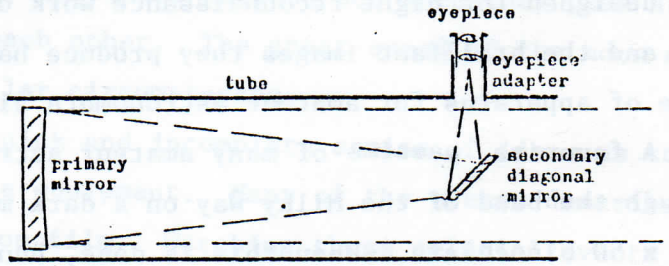
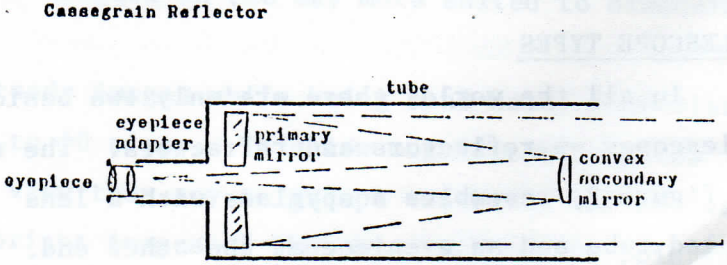


Figure 3



eyepiece. Figure 3 shows a typical Newtonian reflector, with a large mirror at the base of the instrument and a smaller mirror and eyepiece near the open end of the tube. Light passes through the tube and is reflected from the primary mirror back towards the secondary. The secondary diagonal mirror angles the light to the eyepiece.

Figure 4



A modification of the reflecting telescope is shown in figure 4. This is a Cassegrain reflector. In this case, the secondary mirror reflects the light back towards the primary mirror and through a hole cut in the primary. Various modifications of the Cassegrain system include placing a lens across the open end of the tube at the same distance from the primary mirror as is the secondary. This is an attempt to get the best of both worlds -- refractors and reflectors. Such systems are more expensive than simple reflectors, and arguments often rage loud and long as to the merits of each telescope type.

TELESCOPING FOR FUN

Based on the assumption that a telescope is, or soon will be, within your grasp, the question arises as to what is 'up there' to look at. Much depends upon the size of the telescope because, although most of the objects discussed from here on in are visible in all manner of telescopes, it is an unavoidable fact that the larger the primary mirror or objective lens, the greater is the light gathering power of the instrument. This means that fainter objects and better detail are more likely to be seen as the telescope size increases. However, let us ignore these considerations and start poking around in the sky in search of objects of interest.

1) Daytime Astronomy. When thinking of daytime observing, the sun usually comes to mind. Sunspots can often be seen drifting across the solar face. But no matter what sized telescope is used, DO NOT LOOK DIRECTLY AT THE SUN THROUGH ANY OPTICAL INSTRUMENT. It is best to use either a proper filter that is placed over the front of the telescope, or a solar screen that is located behind the eyepiece. If any questions arise as to the safety of an observing method, call the planetarium.

Daytime astronomy also takes in such objects as Venus and Jupiter. When viewed during the day, the contrast between the planet and the background sky is low, thereby allowing details to appear that are often washed out by planetary glare in the evening.

2) The Solar System. Moving into the night skies we find the Moon and neighbouring planets calling for attention. Details of the lunar surface are visible even under low power, and the constantly changing phase of the moon provides various angles of illumination by which to view craters, mountains, rills etc. Mercury and Venus present little more than their changing phases to even a large telescope. However, a variety of markings can be seen on Mars and Jupiter, Jupiter's four large moons provide an ever-changing sight, and the rings, satellites and occasional planetary detail always pleases viewers of Saturn. Searching for, and tracking Uranus and Neptune as they wander among the stars is almost the only option open to viewers of these worlds. And Pluto, even in the largest of instruments, is visible only as a dot of light.

3) Stars. Although to the eye almost all stars appear as single, white dots, telescopes reveal that this is not so. There are long lists of binary stars that offer a pleasing sight when examined telescopically. (A binary star is a pair of stars, held together by gravity, that sometimes are seen as separate dots of light when viewed through a telescope.) Often, the individual stars in a binary system provide a startling colour contrast (such as Albireo in Cygnus which has a blue and yellow star). Larger groupings of stars, or clusters, are scattered throughout the sky. Open clusters, such as the Pleiades in Taurus, contrast rather dramatically when compared with tightly-packed globular clusters such as M13 in Hercules.

4) Nebulae and Galaxies. Also spread across the sky are misty patches of light that cannot be resolved into stars. These may be either nebulae or distant galaxies. Nebulae are glowing masses of gaseous material located within our galaxy. Some better known (and easily observed) examples are the Orion Nebula in Orion, the Ring Nebula in Lyra, and the Lagoon Nebula in Sagittarius. Other patches of light are actually galaxies -- collections of billions of stars at remote distances from us. The Andromeda Galaxy in Andromeda, the Whirlpool Galaxy in Ursa Major and M81 and M82, a pair of galaxies also in Ursa Major are a few of the 'brighter' galaxies visible in telescopes.

TELESCOPING FOR SCIENTIFIC PROFIT

In addition to poking through the sky with a telescope simply for the fun of it, it is still possible to make a contribution to scientific knowledge in the field of astronomy. Admittedly, the major observational and theoretical discoveries remain within the domain of the professional. However, amateur astronomers still have a role to play, should they feel so inclined.

Searching for either comets or novae are two fields that have been left almost entirely to the amateur. Scanning the skies with either low power telescopes or binoculars, amateurs have found hundreds of comets as they approach the sun. While most of these bodies never become spectacular, many are visible for a few weeks in low power telescopes. Novae, or new stars, are much rarer than comets, but amateurs have certainly found their share of these objects. (A nova is not really a new star, but rather one that has suddenly increased in brightness many times.) A familarity with the constellations, and constant sweeping of the night skies with low power instruments are again essent-

ial when searching for these 'new stars'. However, don't expect instant results from initial efforts. W.A. Bradfield, one of the better comet hunters (he found 7 between 1972 and 1978) spends an average of 200 hours actually searching the sky for every discovered comet.

If such hit-and-miss activity does not appeal, there are other possibilities. Hundreds of stars within the grasp of amateur instruments vary their light output over a period of hours, days, weeks, months, or even years. These variable stars, particularly the irregular variables (those stars whose light does not vary through any recognizable pattern) should be constantly observed during the year so that any changes in variation are recorded. The American Association of Variable Star Observers is an organization dedicated to organizing those interested in watching variables. However, lists of variables are available in many texts -- see for yourself if this is an interesting field.

Yet another 'research area' is the timing of occultations of stars by the moon. Lists of occultations visible in a given area are available each year upon request. The only equipment necessary is a telescope, and a method of recording observations to within 0.1 seconds. Accurate timings of the disappearance/reappearance of stars from behind the moon helps accurately locate the moon in its orbit. Grazing occultations (when a star 'grazes' the north or south edge of the moon, blinking in and out of lunar mountains) not only locate the moon but also provide information as to the north-south shape of the moon and the height of lunar mountains. However, grazes are much rarer than standard occultations and it is also necessary to travel in order to view them.

ASTROPHOTOGRAPHY FOR THE AMATEUR

Photography is probably the most important research technique available to the professional astronomer. In the hands of the amateur, its stature changes from that of research tool to a means of simply producing very beautiful images of the celestial wonders of nature. To do this successfully, there are basic techniques used by every amateur astrophotographer.

A. The best all-around camera for astrophotography is the 35mm single-lens reflex. This type is compact, versatile and allows you to see in the viewfinder exactly what's going to be "seen" by the film.

B. The question of which film to use is somewhat more difficult to answer. Generally, whether it be color or black and white, a fast film (ASA 100 or higher) is the best. However, slow fine-grained high-resolution films have their place as well. If you're just beginning, stick with black and white film for your initial experiments. TRI-X film at ASA 400 is the best general-purpose film for astrophotography. Shoot every sort of astronomical subject that you can, carefully record all pertinent data on each exposure and note the results. The mistakes are sometimes just as educational as the good photos. Once you're sure of your technique and basic data like exposure time for all the subjects you'll be shooting, then and only then should you move on to color film and more exotic varieties of B & W.

C. With a camera equipped with a normal lens (usually a 50 mm f/1.8 or f/2), a tripod, locking cable release, and some film, you're ready to start doing astrophotography.

Within reach of this basic setup are certain types of astronomical subjects like:

1. Aurora (5 to 20 sec. exposures)
2. Planetary conjunctions (¼ to 10 sec.)
3. Constellations (no longer than 15 to 30 seconds to avoid star trailing).
4. Bright comets (5 to 60 seconds)
5. Star trails (1 min to 1 hour exposures in a dark sky)
6. Meteors (usually captured while taking star trail pictures).

D. To graduate to a more advanced brand of astrophotography requires a telescope, one with an equatorial mount (as opposed to the simple altazimuth mount) and a clock or motor drive unit on the polar axis that drives the telescope at the same speed but in the reverse direction to the earth's motion, preventing the blurring or "trailing" of celestial objects over long exposures.

There are several ways to attach a camera to a telescope.

1. Afocal camera: This is a technique whereby the camera with its own normal lens is mounted so that it's "looking" into the telescope eyepiece. Typical subjects for this method are full disk images of the sun and moon, satellite configurations around Jupiter and Saturn, and lunar and planetary detail at high magnifications. Exposures for these sorts of subjects are from 1/500 to 30 seconds.

DO NOT ATTEMPT ANY SOLAR PHOTOGRAPHY WITHOUT TAKING PROPER PRECAUTIONS TO FILTER THE LIGHT. A solar filter that fits over the front of the telescope and not at the eyepiece end is the best type. Contact the Planetarium or the R.A.S.C. for advice on this.

2. Prime Focus Camera: Here we remove the camera lens and the telescope eyepiece and use the telescope's main mirror or lens as the photographic lens itself. The same sort of subject listed under

the afocal method are applicable here as well but the straight-through prime focus technique yields much better resolution.

With the addition of more elaborate equipment, photographs of deep-sky objects such as star clusters and nebula can be made, but these require exposures of anywhere from 10 minutes to 1 or 2 hours. Over exposure times such as these it is necessary to manually "guide" the telescope to insure that it points to exactly the same spot in the sky throughout the exposure. Even with a motorized clock drive, guiding is still necessary because of factors like atmospheric refraction, machining errors in the motor gears and failure to align the telescope's polar axis directly on the north celestial pole. Needless to say, this is one of the most demanding areas of astro-photography, but one that can yield results rivalling that of professional astronomical photos.

3. Eyepiece Projection: For photographs of the planets and close-up areas of the sun and moon, considerably more magnification is required than is available using only the prime focus method. To achieve this sort of magnification, an eyepiece is inserted into the telescope-to-camera adapter in order to project its image directly onto the film.

Exposures with reasonably fast film are anywhere from 1 to 10 seconds. To insure sharp images of the planets or small sections of the moon, the atmosphere must be very steady and there must be absolutely no vibration transmitted through the telescope.

4. Piggyback Photography: This variation again uses the camera with its own lens but instead of fixing it to a stationary tripod, the camera is attached to the side of the telescope tube with a suitable bracket. The trick here is to point the telescope/camera combination

to a sky area of interest, say a particular constellation or section of the Milky Way, select a guide star visible in the telescope eyepiece, open up the camera shutter with the lens at f/2 or f/2.8 and expose the film for several minutes to an hour or so. During the exposure the telescope is again guided both electrically and manually to prevent unwanted star trailing.

Very faint objects can be recorded this way. The Milky Way, for example, can show up on a well-guided time exposure photo as a blaze of glowing cloud stretching across the sky. For any long exposures of faint stars, deep-sky objects and the Milky Way, you require a dark observing site well away from the glare of city lights.

For more detailed information on this subject, here are a few recommended sources.

Brown, Sam; All About Telescopes; Edmund Scientific Co., Barrington, New Jersery, 1975 (contains a fairly comprehensive section on adapting your camera and telescope for photography). This book is available at the Planetarium bookstore for $6.50.

Paul, Henry; Outer Space Photography for the Amateur; Sky Publishing Corp., 49-50-51 Bay State Road, Cambridge, Mass. 02138 This book is available at the Planetarium bookstore for $10.95.

"Astronomy" a colorful monthly magazine featuring a regular department for astrophotography. Available at the Queen Elizabeth Plnaetarium for $1.75 per issue.

Plus: The public library has a large section devoted to astronomy containing several titles dealing with astronomical photography.

The monthly R.A.S.C. meetings often deal with the techniques and results of amateur photographers. Several R.A.S.C. members are active in this area and would be glad to assist you as you get started in this challenging pursuit.

The Edmonton Centre of the R.A.S.C. and the Queen Elizabeth Planetarium hope you have enjoyed STARNIGHT ' . If you would like to learn more about the R.A.S.C., we invite you to attend one of the regular monthly meetings. These are held every second Monday of each month (except July and August) at the Queen Elizabeth Planetarium. Meetings start at 8:00 pm and feature a speaker discussing some topic of astronomical interest.

NOTES

APPLICATION FOR MEMBERSHIP

ROYAL ASTRONOMICAL SOCIETY OF CANADA

EDMONTON CENTRE

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STUDENTS: (under 17 yrs)	$8.50
ADULTS:	$13.50
LIFE MEMBERS:	$150.00

All memberships include:

The Observer's Handbook (published yearly)

Journal of the R.A.S.C. (published bi-monthly)

STARDUST (published 11 times each year by the Edmonton Centre)

Free admission to Planetarium programs upon presentation of membership card.

A Membership Year runs from October 1 to September 30. For further information, call the planetarium at 455-0119 or write:

TREASURER, c/o Queen Elizabeth Planetarium
Coronation Park,
Edmonton

THE ROYAL ASTRONOMICAL SOCIETY OF CANADA

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