ABRAMS PLANETARIUM

SKY CALENDAR JANUARY 1986

An aid to enjoying the changing sky

CURRENT SKY INFORMATION:
Call (517) 332-STAR

Use this scale to measure angular distances between objects on diagrams below.

0° 10° 20°

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
Planets at Dusk: Jupiter bright, sinking SW to WSW. **At Dawn: Mercury, Mars, Saturn;** see diagrams.	**Comet Halley** is faintly visible around end of evening twilight. See notes left margin and within calendar.	**Diagrams** show sky in mid-twilight, ¾ hr after sunset or ¾ hr before sunup, except Jan 27, 28.	1 Comet Halley, inbound, crosses Earth's orbit. Tonight comet is 1.18 a.u. (110 million mi) from Earth and 0.99 a.u. (92 million mi) from Sun. As evening twilight ends, look 18° above Jupiter and 3.2° left of 3rd-magnitude Alpha Aquarii.	2 At midnight E.S.T. at the start of January 2 (9 p.m. P.S.T. on Jan 1), Earth passes the perihelion point of its orbit. Distance from Sun: 0.983 astronomical unit (91.4 million miles).	Morning: 3 Last Quarter Moon Spica End of eve twilight: Halley 3.0° lower left of Alpha in Aquarius.	Morning: 4 High in south. Moon Spica
Sunday, Monday, and Tuesday mornings, January 5, 6, and 7; Mercury, approaching Sun, becomes quite hard to see by midweek. Mars Jan 5 Beta Librae Jan 6 Mars Jan 7 Alpha Librae Spica Moon Jan 5 Moon Jan 6 Saturn Moon Jan 7 Antares Watch Mars pass 0.7° of 3rd-mag Alpha Lib Jan 8. ESE Mercury SE SSE S			Wed Jan 8, morning: Saturn Antares Mercury about to rise here Old Moon in SE	**Magnitudes in Jan** Jupiter: −2.0 Mercury (Jan 1-7): −0.4 Saturn: +0.6 Mars: +1.4 to +1.1 Halley (Jan 1-26): 5.8 to 4.4 (uncertain)	10 New Moon 7:22 a.m. E.S.T. (4:22 a.m. P.S.T.) Diagrams for Jan 11-13, 20, 26 show Halley's Comet in mid-twilight, about ¾ hour after sunset. Sky is too bright to see comet then; wait another ¾ hour, when twilight ends, and sky will darken.	Halley's Comet Jan 11, evening: β Aqr Jupiter SW Young Moon
Jan 12, evening: Halley's Comet β Aqr Moon Jupiter SW	Jan 13, evening: Moon Halley's Comet β Aqr Jupiter SW	14 Each day Halley moves ½° (about one moon's width) to west against background stars, while Jupiter shifts less than ¼° east. Watch them pass each other next week, before they sink into twilight. Both will be hidden on far side of Sun in February. Monday and Tuesday evenings, Jan 20 and 21: High E to ESE. Pleiades Moon Jan 20 Hyades Moon Jan 21 Aldebaran	Jan 15, morning: Alpha Lib. Mars Saturn Antares SSE End of eve twilight: 22 Halley 1.4° left of 3rd-mag Beta in Aquarius.	16 In next 10 days, moonlight and twilight increasingly spoil viewing of Comet Halley.	17 Moon at First Quarter, 90° (¼ circle) E of Sun in afternoon and evening sky.	**Motions Jan 1 - Feb 1:** **Sun** 32° E, Sgr – Cap **Mars** 19° E, in Lib **Jupiter** 7° E, in Cap **Saturn** 3° E, Sco – Oph **Halley** 16° W (0.6° to 0.5° per day), in Aqr
19 Venus at superior conjunction, beyond Sun. Comet Halley crosses inside Venus' orbit tomorrow; appears 9° due N of Jupiter tonight and 8° from Jupiter Jan 20-26.	Jan 20, evening: Halley's β Aqr Jupiter WSW			23 Moon Castor Pollux Procyon ENE E	24 Voyager 2 flyby of Uranus. Evening: Castor Pollux Moon Procyon ENE E	25 Evening: Castor Pollux Halley sets 10° S of due west at end of evening twilight (from mid-northern latitudes). Full Moon ENE E
Evening: Can you still see comet? It & Jupiter set before end of twilight. 26 α Aqr Halley's Comet β Aqr Jupiter WSW	Three hours after sunset: 27 Regulus Moon E ENE	Three hours after sunset: 28 Regulus Moon about to rise here ENE E	Morning: 29 Mars Saturn Antares Watch Mars pass Saturn next month. SSE S	30 Mercury at superior conjunction (beyond Sun) tomorrow, and emerges into evening sky by mid-February. Year's best view of Mercury in evening is late that month. ***Sky Calendar*** for Feb and March will locate the planet.	Morning: 31 SSW to SW. Spica Moon Comet Halley, only 10° from Sun, is hidden deep in sun's glare. Comet emerges into morning sky by end of February.	1986 is a fine year! Saturn, Mars, Jupiter, and Venus in turn reach their greatest brilliance in years. ***Sky Calendar*** will follow these planets, as well as Comet Halley at its brightest in morning sky in March and early April, and in evening sky late April into May. Stay with us! Subscription address below.

Locating Halley: The comet is still dim—predicted mag 6 to 4½, fainter than Andromeda Galaxy. So these explicit directions may be helpful. Start observing from a very dark site near end of eve twilight, which is about 1½ hours after sunset. Find bright Jupiter in SW to WSW. About 10° to its upper right, locate the 3rd-mag star Beta Aquarii. (A clenched fist held at arm's length covers about 10° of sky. Calibrate your fist using the Pointers of the Big Dipper, 5° apart.) Although faint, Beta should be unmistakable, since there is no equal or brighter star within 10° except for another 3rd-mag star, Alpha, just 10° above Beta. See finder chart, ***Comet Halley Inbound,*** mailed to ***Sky Calendar*** subscribers. In first 3 weeks of Jan. Comet Halley remains just left of the line joining Alpha to Beta. Sliding downward, Halley is 3.2° left of Alpha Jan 1, and 1.4° left of Beta Jan 22. Once you've located Halley, it should be easy to find again on subsequent nights. From one night to the next against background stars, Halley shifts only about ½°—the apparent width of the Moon. But the entire star field gets lower each night, taking Jupiter and Halley along with it. **Appearance of Comet:** A faint, diffuse patch of light visible with binoculars and perhaps unaided eye. A dust tail might grow out of the 5th-mag coma (head of the comet) by early Jan, but increasingly moonlight seriously hampers viewing after midmonth. By Jan 26, Halley sets in twilight and is not likely to be seen.

Robert C. Victor, Jenny L. Pon, Robert D. Miller

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Halley Highlights

November 1985-May 1986 and beyond

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Note: Predictions of the comet's brightness are uncertain.

1985 Nov. Comet brightens from mag. 9 to mag. 6 and becomes visible in binoculars; passes Aldebaran, Pleiades; visible all night at midmonth; crosses orbit of Mars; first close approach, 58 million miles from Earth, is on night of Nov. 26 with comet near Gamma in Aries, but full moon interferes. Starting Nov. 30, sky is dark and moonless at end of evening twilight, which allows better comet viewing.

1985 Dec. Best time to look: at end of evening twilight (about 1½ hours after sunset). Receding from Earth as it is drawn closer to the sun, Comet Halley brightens only slightly to become dimly visible to the unaided eye in a dark sky (for the first time since 1910!). Passing below the Great Square of Pegasus high in the southern early evening sky, the comet goes through the Circlet of Pisces Dec. 11-14 and ends month near Water Jar in Aquarius. Moonlight becomes a problem latter half of month. Starting Dec. 29, sky is again dark and moonless at end of evening twilight. Moonlight won't be a problem again until mid-January, when comet's low altitude in twilight will also interfere.

1986 Jan. 1-25. Moving westward toward the sun, Comet Halley brightens to about magnitude 4½ and develops a dust tail. Best time to look is still end of evening twilight, about 1½ hours after sunset. On Jan. 12 comet is 13° north of crescent moon, and during Jan. 20-26 comet is 8° north of Jupiter. But comet sets 10° south of due west at end of twilight on Jan. 25, and is thereafter lost in the sun's glare.

1986 Jan. 26 to late Feb. Comet lost in sun's glare as it passes on the far side of the sun. Perihelion (comet nearest sun) Feb. 9, comet 0.587 astronomical units (55 million miles) from sun—inside Venus' orbit.

1986 late Feb. to Apr. 5. Comet best seen as morning twilight begins, about 1½ hours before sunrise.

1986 Feb. 24. Head of comet rises in ESE as twilight begins from lat. 40° N. Tail rises first; head is 26° lower right of bright Altair. Less interference from moonlight after Last Quarter on March 3.

1986 Mar. 7-21. Sky dark and moonless at start of morning twilight. Comet, now mag. 2½, sprouts a long tail, perhaps over 20° in length, and attains an altitude of nearly 10° up in SE. Look to left of Teapot of Sagittarius.

1986 Mar. 22 to Apr. 6. Bright moon interferes Mar. 22-Apr. 1; dipping far south, comet passes below Teapot and 17° below Mars Mar. 27-Apr. 2, and below tail of Scorpius Apr. 3-6.

1986 Apr. 6-13 Comet reaches greatest brilliance (second magnitude), but unfortunately it is too low to be well seen from northern U.S. From latitude 40° N on these dates, the head of Halley's Comet is never more than 5° above the horizon. The tail—at least 20°, and perhaps even 40° long—extends to the upper right, and should be seen even if the head of the comet is hidden in the low horizon haze. On these dates the comet is highest in morning darkness hours, when it passes exactly due south. This occurs on Apr. 6 at about 4 a.m. local time, and about half an hour earlier each morning. On Apr. 7 the comet is due south about 3:30 a.m. and is located 27° below Saturn and 20° below Antares, the reddish star marking the heart of the Scorpion. The comet dips farthest south on Apr. 9; from latitude 40° N, it is highest and due south at 2:30 a.m., only 3° above the horizon. The comet makes its closest approach to Earth (distance: 39 million miles) on Apr. 10; it is due south that morning at 2:00 a.m. By Apr. 13 the comet passes due south at about 12:30 a.m.

1986, night of April 13-14. Comet low in south about 10 minutes after midnight. Altitude: 5° up (as seen from lat. 40° N).

1986 Apr. 14. Best time for viewing comet now shifts to the late evening. Tonight the comet is due south at 11:45 p.m. Look some 30° below Spica. From lat. 40° N, the comet is 8° above the horizon. The crescent moon, 30% full, will then be low in the west-northwest and does not interfere.

After April 14, 1986. Each evening, as the comet moves northwestward against background stars, it reaches due south a little earlier and is higher in the sky. On the evenings of the 17th and 18th, the fading third-magnitude comet is about 12° below the prominent quadrilateral of stars marking Corvus the Crow, and crosses due south some 15° above the horizon (from lat. 40° N) around 10:30 p.m.

But moonlight begins to interfere. The moon reaches First Quarter (half full) on April 17th and full on the 24th.

Beginning Apr. 25th, the moon rises after the end of evening twilight, and again poses no problem for comet watchers. The 4th-magnitude comet is then in the faint constellation Crater, to the west of Corvus, and is about 25° up just east of due south as twilight ends. The tail may still be 10° to 15° long. The comet may be followed with the unaided eye south of the constellation Leo until mid-May, when moonlight again interferes. The comet will then be slightly brighter than 6th magnitude.

When the moon is out of the way again on May 25th, the comet will have faded to 7th magnitude, and binoculars will be required to see it.

Amateur telescopes will keep Halley in view until early in summer, when it sinks into the western twilight glow. Larger scopes will recover it in the morning sky by early November 1986, when it will have faded to 13th magnitude.

Receding to beyond Jupiter's distance in February 1987, Comet Halley won't be seen from planet Earth with unaided eye again until the year 2061.

— Robert C. Victor

RESOURCES

The Abrams Planetarium monthly ***Sky Calendar*** provides night-by-night illustrations of gatherings of Moon, planets, and stars, a simplified evening sky map, and additional coverage of Halley's Comet. Subscription is $5 per year, starting anytime, from Abrams Planetarium, Michigan State University, East Lansing, MI 48824.

Annual sky almanacs

Astronomical Calendar by Guy Ottewell. $10 from Astronomical Calendar, Dept. of Physics, Furman University, Greenville, SC 29613

Observer's Handbook. $9 U.S. from Royal Astronomical Society of Canada, 136 Dupont St., Toronto, Ontario M5R 1V2 Canada.

Other periodicals

Astronomy. 625 E. St. Paul Ave., P.O. Box 92788, Milwaukee, WI 53202. The 144-page Oct. 1985 issue ($2.50) is a special edition on Halley's Comet.

Sky & Telescope. 49 Bay State Road, Cambridge, MA 02238. Has excellent Halley finder charts.

Mercury. Astronomical Society of the Pacific, 1290 24th Ave., San Francisco, CA 94122.

Dark Skies for Comet Halley Journal. $4 per year; includes ***The Reflector.*** Write Astronomical League, P.O. Box 12821, Tucson, AZ 85732. You can request information about astronomy clubs in your area; include SASE with request.

Books and Pamphlets

(All published in 1985; some publishers add shipping charges.)

The Comet Book, R. Chapman and J. Brandt. 168 pages, $14.95. Jones and Bartlett Publishers, Inc., Boston.

The Comet Handbook, G. Stasiuk and D. Gruber. 33 pages, $5. Stasiuk Enterprises, P.O. Box 12484, Portland, OR 97212.

Fire and Ice: A History of Comets in Art, R.J.M. Olson. Published for National Air and Space Museum, Smithsonian Institution, by Walker and Co., New York.

Halley's Comet!, F. Reddy. 60 pages, $9.95. Astromedia, P.O. Box 92788, Milwaukee, WI 53202.

Halley's Comet Finder, B. Mayer. 80 pages, $5.95. Perigee Books (Putnam), New York.

Halley's Comet: A Mysterious Visitor From Outer Space, T. Dickinson. 125 pages, $8.95. Edmund Scientific Co., 101 E. Gloucester Pike, Barrington, NJ 08007.

Mankind's Comet, G. Ottewell and F. Schaaf. 200 pages large format, $20. Astronomical Calendar, Dept. of Physics, Furman University, Greenville SC 29613.

The New York Times Guide to the Return of Halley's Comet, R. Flaste, H. Noble, W. Sullivan, and J. Wilford. 244 pages, $7.95. Times Books, Random House, New York.

Mr. Halley's Comet. 32 pages, $2. Sky Publishing, 49 Bay State Road, Cambridge, MA 02238.

The Return of the Comet: An Activity Book for Skywatchers from 9 to 14 with Adult Teaching Guide, D. Schatz. 42 pages, $7.95. Pacific Science Center, 200 2nd Ave. N., Seattle, WA 98109.

The Return of Halley's Comet. 36 pages, $4. Astronomical Society of the Pacific, 1290 24th Ave., San Francisco, CA 94122.

THE 1985 GENERAL ASSEMBLY, EDMONTON

By GUY WESTCOTT

This being my third G.A. in five years, I was ready for just about anything, but not the beauty of the Edmonton Space Sciences Centre. For me that was the centrepiece of the Edmonton G.A.. The Devonian Theatre houses a hugh IMAX Screen, four stories tall. Screening this particular weekend was the 70mm film, The Grand Canyon. It never looked like that when I visited it. Spectacular views from amazing locations. You almost needed seat belts on the chairs. I can hardly wait for the Shuttle movie in 70mm.

I was unable to get to many of the paper sessions due to Council meetings and business meetings, but what I did see was of extremely high calibre. When you see amateur astronomers get up on stage and deliver quality papers, it makes one proud to be a member of the R.A.S.C..

After a walking tour of Edmonton City Centre on Saturday evening and a quick run on the RTS (rapid transport system) we were treated to a mouth-watering beef banquet at the Edmonton Convention Centre. As for the other tours, I found it necessary to confiscate my mother's cheque book before touring the West Edmonton Mall. They do stuff bigger in Texas, huh! I would estimate that you would need at least three days and $15,000 to go around the whole mall, and it's not finished yet.

The fun of it all is in the late night meetings, after the days events, when members get together and chew the fat about what their centres are planning and current projects in the mill.

Summing up, the Edmonton G.A. rated an 8 out of a scale of 10. I have not as yet attended a 10 out of 10. WELL DONE EDMONTON for an excellent G.A. and thanks to the Pattersons in Saskatoon for accomodating us to and from Edmonton.

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THE 1986 WINNIPEG GENERAL ASSEMBLY

These are some of the highlights of the 1986 General Assembly to be held in Winnipeg as part as our 75th Anniversary.

Fri June 27	First National Council Meeting Buffalo Bash (Wine and Cheese Party) Bad Slide Night (Murphy's Law Contest)
Sat June 28	Paper Sessions with beginning Guest Speaker Winnipeg Tour including Goverment House and Planetarium Evening Riverboat Cruise
Sun June 29	Paper Sessions with final Guest Speaker General Assembly Meeting Awards Banquet and Birthday Party
Mon June 30	Tours of Pinawa Nuclear Research Station and Seven Sisters Hydroelectric Power Plant

Be certain to be included in these events and to assist the G.A. Planning Committee. Just contact one of the Council members for information.

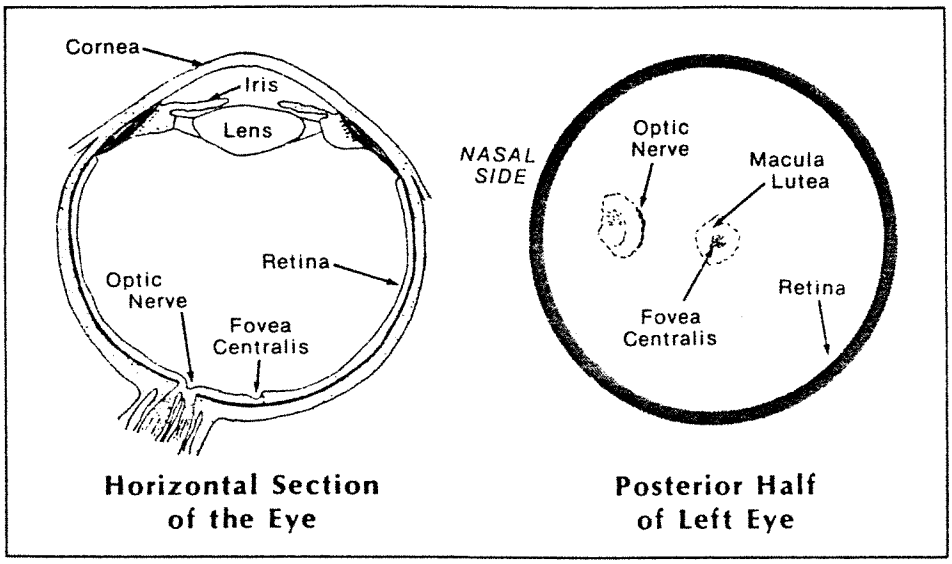
THE 1986 G.A. PLANNING COMMITTEE

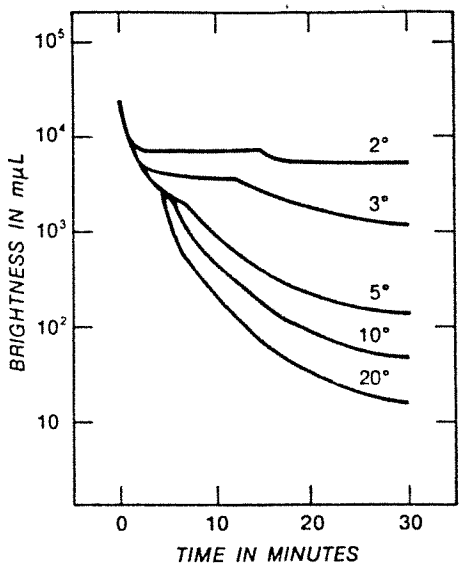
The history of winter observing reveals that it is not all that glamorous if simple precautions and some common sense are not observed. If we are unprepared, winter outings can all too often become more of a chore than a pleasure. We end up tackling dew and frostbite while our favorite objects which we so eagerly want to see, are setting.

If you are fortunate enough to have a heat-up hut or a cabin, as I do, to retreat to after each observing session, all the better. But there are still a few details that should not be overlooked. All astronomical optics can endure sub-zero temperatures, but the worst thing one can do is to bring them into the warmth unprotected, especially the eyepieces, since dew collects even inside them. The rule is to encase all optics as airtight as possible when they undergo temperature changes from cold to warm. If you do not have adequate dew caps for your 'scope they can be easily made from vinyl. For eyepieces, a zip-lock bag with as much air squeezed out of it as possible, is perfect. When I need to de-fog an eyepiece I find it does the job well by putting it in an inside pocket to warm up. Our breath can also deteriorate viewing without our ever realizing it. One way to avoid this is to acquire a dew cap or guard for the eyepiece. Another solution is to avoid breathing around the focuser and finder altogether. I find that taking a few deep breaths before peering through the 'scope also improves my eyesight, but whether this is a physical or psychological effect I do not know! If electricity is available, special heat elements can be made for the eyepiece and the front of the main tube, but at ever so slightly higher temperatures than the surrounding air. Up north in Rawdon where I have my cabin, I don't have electricity so I have developed something that works quite well. I've made a mask to breathe through with a flexible tube which is inserted inside the front of my jacket by the neck opening through a scarf.

Sometimes if the weather is too harsh we just would not venture out for casual observing, but, what if in midwinter a spectacular comet, supernova, bright lunar graze or the like, occurs? Well, we probably frantically rush out to a dark location and by misfortune forget something or other like the usual film, camera or certain accessories. When we get there we soon find out that we are not impregnable to the weather and neither is the car. Remember, unlike skidoo-ing or ski-ing, you are virtually standing still when viewing through your 'scope and consequently at least twice the normal winter protection is needed, from head to toe! This does not mean you need to gain 50 pounds every time you go out, or take a survival course, but I would recommend a check list. You might want to include in the list the following: warm comforter (or arctic sleeping bag), Coleman camp heater which uses naphtha fuel (this heater gives off 750 watts of heat for approximately 12 hours - perfect for the interior of the car), and food which is high in energy and is quickly absorbed by the body (honey, chocolate, maple syrup, etc.) but no heavy food which will rob the body of energy when digested - energy which is needed to stay warm.

According to Gary Boyle (and I am in full agreement with him) many fine nights can be relished in spring, summer and fall when you will still be able to view the entire sky, but Canadian winter nights are known to be superb and steady, if one wants to brave the cold. For me, on numerous occasions winter observing has been well worth it and, as far as I know, for many other observers as well. This is the time of the year when we have a chance to view any type of object we wish practically straight overhead and therefore in a position for the most advantageous perception. I can think of no other time that is as good for viewing the nearest and brightest galaxies, the largest and best open clusters, or even the different nebulae. At what other time of the year can you catch M31 and her companions, M33, M81-82 or, for that matter, the greatest nebulae of them all (M42) at their highest point in the sky? So, if you are prepared to accept the challenge, there is a whole Universe out there waiting to be uncovered with the aid of the powerful eye of a telescope in winter, when the sky clears to that certain blue, right down to the horizon.





Left: The fovea centralis of the eye has no rods, the receptors most sensitive to light. They begin to occur in the macula lutea, off the optical axis, which accounts for averted vision's success in detecting faint objects.

Right: As the eye rests in darkness, the detectable threshold brightness decreases. The threshold is lower for objects of larger angular extent, as shown here. These curves are for centrally fixated fields; if averted vision is used for small objects, significantly fainter illumination can be detected. Adapted from a National Bureau of Standards chart.

This article was taken from SKYWARD, the Montreal Centre Newsletter (Jan/Feb 1985). It contains some good hints on preparations for winter observing. - Editor.

The Winter Challenge

by: Steve Cekovic

One may wonder why any sane individual would venture out to the country in mid-winter with a telescope: a pair of skis or a snowmobile, okay -- but a telescope? The answer is simple: a compelling passion for the beauty of the heavens revealed in the night sky. It is hard for any serious observer to resist an outing at any time of the year when the sky turns that special blue shade which indicates very good, if not superb "seeing". But, since the winter sky has a unique character all its own, carrying with it a multitude of splendid objects which can be found in no other part of the sky, and since the best time to enjoy these objects is when they are at their highest in the sky, no time is better than winter for observing them.

Not only are there interesting deep-sky objects to independently re-discover, and the usual grazes and occultations, but also two great meteor showers return. I remember in 1969 when my friend and I scrambled to a roof-top glazed with ice and snow to view the intense Geminids. By about midnight the shower had grown to a marvelous showpiece. During thirty minutes 20 to 25 fireballs were viewed, some of which were slowly and silently riding through the upper atmosphere at different angles, while others travelled toward us, brightening dramatically and then quickly disintegrating into vapor. One in particular is hard to dismiss from the mind: at first it grew from a speck of light to a bright image within a second. To our surprise it grew in intensity as it approached us, which gave us the distinct impression that we were about to be hit. How relieved, and at the same time, delighted we were when the mighty fireball finally exploded into an uncountable number of fragments of varying degrees of brightness, filling a 3° area. Although this episode lasted no longer than 5 seconds, it seemed like an eternity. I have never to this day been fortunate enough to witness such a sight again, but I am still moved whenever a see a fireball and I will never cease to enjoy meteor showers.

9th magnitude or fainter will usually provide at least two stars for reference in the field of a low-power eyepiece. A 9th-magnitude limit, rather than a 6th, also makes it much easier to identify a field in your finder. In using the charts, it is helpful to make a mask with a hole the same diameter as the finder field. By centering this on the subject, you can tell exactly what stars will be seen in the sky.

A proper chart may also be essential for identifying certain objects. For example, in the Coma-Virgo area, faint galaxies are abundant, and their identification is ambiguous unless you can see some stars in the field.

Finders should have crosshairs. Each evening their intersection should be placed on a bright star, to make sure that it also appears in the eyepiece of the main telescope. In practice, it is not necessary to adjust the finder for a small misalignment — just remember where the center of the telescope's field is in relation to the intersection. A finder should also reach the limiting magnitude of the star atlas, so a 2-inch is needed if your atlas goes to 9th magnitude. For use with a Newtonian telescope, it is a good idea to insert a roof prism in the finder so that the eyepiece is turned at a right angle, parallel to the one on the main instrument.

Setting circles are efficient only on a telescope with a drive, and its equatorial mounting must be accurately aligned on the celestial pole. One method is to use the little-known AAVSO "Path of North Pole" chart to point the polar axis to the current position of the pole. This technique is superior to direct offset from Polaris, unless special care is taken.

Since the positions of deep-sky objects are still given mainly for the epoch 1950, the coordinates are now in substantial error due to more than 30 years of precession. The change in position is greatest along the ecliptic, and in 1980 it amounts to more than 0°.4. Current positions can be derived with the aid of precession tables or calculated. But even if this is done, the object should be plotted on a star atlas to aid finding it after the circles have located the general field.

Dark adaptation. In the dark, the iris of your eye expands to let in as much light as possible. Also, through a chemical process, the rods of your retina become more sensitive to low-level illumination. This increased sensitivity is called dark adaptation. The rapidity with which people become totally dark adapted varies greatly. Although the most dramatic dark adaptation occurs in the first few minutes, sensitivity continues to improve for at least half an hour as the eye rests in uninterrupted darkness.

At the telescope, the brightness of the sky background can undo some of this adaptation, particularly if wide-field eyepieces are used. Even light coming through the slit of an observatory dome can degrade maximum sensitivity. To see very dim objects, cover your head with a black cloth to keep out stray light.

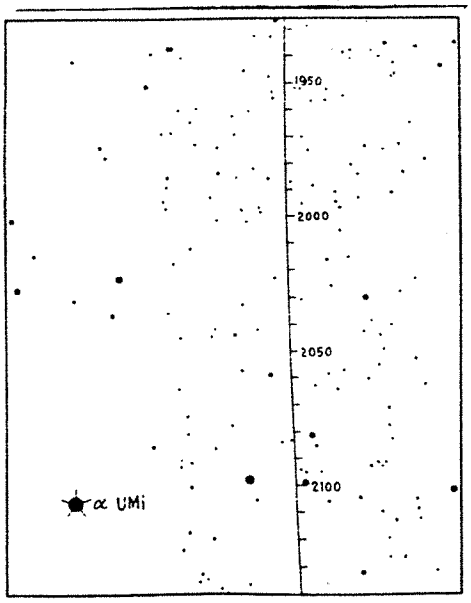
Averted vision. To see a particularly dim object, center its location in the field and direct the axis of your eye 10° to 20° to one side, though keeping your attention fixed on the target spot. This is easier than it sounds, and veteran observers do it automatically. As much as two magnitudes can be gained, except by a few people who lack this increased sensitivity toward the edge of the retina. Curiously, once you have located some object by averted vision, it can then often be seen by direct vision.

Dew and scattered light. For best viewing, it is very important to prevent any accumulation of dew on optical surfaces. Similarly, any reduction in scattered light will increase contrast and definition, thus providing crisper views and fainter magnitudes. Minimizing scattered light is straightforward — keep all optical surfaces free from dust and scratches; also, make sure the light path through the telescope is properly shielded or baffled to avoid extraneous light or internal reflections.

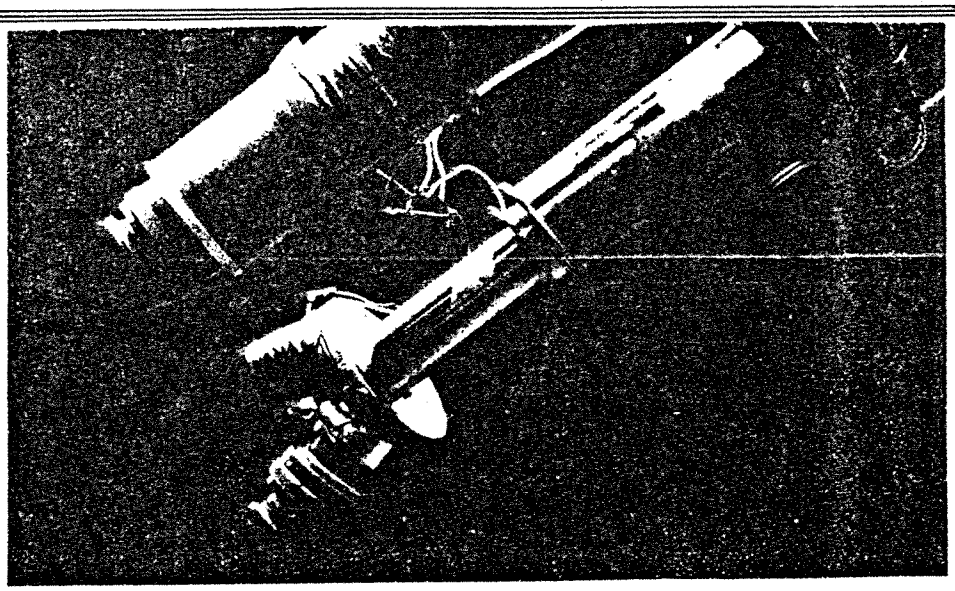
The suppression of dew is more subtle, and over the years a variety of solutions have been tried, including dew caps, electric fans, and hair dryers. In my opinion, these devices do not work well. From 40 years experience, I've concluded that the best way to prevent dewing is to apply gentle heat to all optical elements, including the objective. I suggest wrapping flat Nichrome "toaster" wire around the optical elements, and passing one to three volts from an AC toy transformer through the wire.

My 4-inch Alvan Clark refractor has its objective, finder, and multiple-eyepiece mounting heated in this fashion. To my surprise, the heaters didn't degrade the optical quality of the telescope, contrary to conventional wisdom, except for the first few minutes when the system was reaching thermal stability.

Another surprise was that the heaters distinctly improved the image, even in air many degrees warmer than the dew point. So dramatic is this change that I know when the heaters stop working because my limiting magnitude suffers. Furthermore, experiments with double stars revealed that closer pairs could be resolved with the heaters on. Planetary detail is also uniformly improved.



This section of an AAVSO chart shows the precessional drift of the north celestial pole relative to the stars. Right ascension 12h is up, 6h to left.



On the author's 4-inch refractor the turret eyepiece holder is equipped with a heating element to prevent dew formation. Another element is on the body of the finder. Photograph by Mr. Houston.

Observing the Deep Sky

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EDITOR'S NOTE: This article is part of the *Sky and Telescope Guide to the Heavens*, companion to the *AAVSO Variable Star Atlas*, now available from Sky Publishing Corporation.

AMONG the most popular targets for amateur telescopes are star clusters, nebulae, and galaxies. Apart from a few conspicuous open clusters that are easily resolved into stars, these deep-sky objects appeared as hazy patches of light in the small telescopes of Charles Messier's time (1730-1817), so they were generally known as nebulae. This is also how you will see them in your telescope, for the most part. Only much later, after the advent of spectroscopes and large photographic reflectors, could astronomers distinguish clearly between the true nebulae (which are gas clouds) and galaxies (which are made up of faint stars). Let's look at the types of objects you can observe.

DENIZENS OF THE DEEP SKY

Galaxies are huge assemblages of millions or billions of stars. Though they take on a wide variety of forms, those of interest to amateurs are of four basic types. But do not expect to see the characteristic features of these types in your telescope, for they are usually too faint.

Spiral galaxies are rather flat disks with pinwheel arms and a bright central bulge. When seen face on they appear circular; when edge on they are oval or cigar-shaped. Few galaxies are found in or near the Milky Way (which is actually the disk of our own galaxy projected on the sky), for the dust there dims the light of these distant systems. On the other hand, areas in Virgo and Coma Berenices contain rich swarms of galaxies, with many members visible in modest instruments.

The second major type encompasses the elliptical galaxies, which appear circular and have no trace of spiral structure. These galaxies also lack the great dust lanes that are so conspicuous in photographs of spirals.

Dwarf galaxies are much smaller than the above types, and they shine with relatively feeble light. Thus, dwarfs are difficult to detect, and only ones near our own galaxy are known.

A minority of galaxies have odd shapes, and these are called irregular.

Amateur instruments will reveal examples of all these types. M31 in Andromeda is a spiral with an elliptical companion, M32; Barnard's galaxy (NGC 6822) in Sagittarius is a dwarf; and the Magellanic Clouds, familiar to Southern Hemisphere skywatchers, are irregulars. All these objects, together with our galaxy and about a dozen others, belong to a small cluster called the Local Group.

Most galaxies visible in amateur instruments are only a few minutes of arc in size. Their brightnesses stretch from naked-eye visibility to whatever limit a telescope can reach.

Globular clusters are huge balls of several hundred thousand stars. Most of these clusters are seen around the center of our galaxy, in the constellations of Sagittarius, Scorpius, and Ophiuchus.

Amateurs will be able to resolve individual stars only around the edges of the larger globulars. With few exceptions, their apparent diameters range from 15′ to less than 1′, magnitudes from 6 to fainter than 14. For Northern Hemisphere observers M13 in Hercules is the most popular globular; its Southern Hemisphere counterpart is Omega Centauri.

Open clusters are loose assemblages of tens to several hundred stars and are usually resolvable in amateur telescopes. These clusters are generally located near the plane of the Milky Way, and some contain nebulosity (as in the Pleiades). The bright stars in Coma Berenices form a huge open cluster 5° in diameter, while some faint, distant groupings are only a few minutes of arc across. Because the stars are quite scattered, their total light (the integrated magnitude of the cluster) is not a good indicator of the cluster's visibility.

A **planetary nebula** is a shell of gas that is excited to shine by a hot central star. In small instruments, these nebulae often appear as dim featureless disks, like the ghosts of planets, hence the name. The largest planetary is the Helix in Aquarius, about ½° in diameter, but many are only a few seconds of arc across and difficult to distinguish from stars. The total magnitude of a planetary tells little about its visibility, if the light is spread over a large area. More useful is the surface brightness, which is proportional to the total light divided by the area. The central stars are rather inconspicuous, rarely as bright as magnitude 12. M57 in Lyra is a typical planetary, perhaps the finest in a class of objects that some amateurs find the most difficult to observe.

Galaxies such as our Milky Way are filled with interstellar gas and dust. Sometimes a bright star illuminates a cloud of dust to produce a reflection nebula, or ultraviolet radiation from a hot star may cause the gas to glow. In either case, we see a **diffuse nebula.** The most spectacular example is M42 in Orion. **Dark nebulae** are dust clouds seen silhouetted against bright nebulae or more distant star fields, hiding them to create "starless" regions. These nebulae, such as the Horsehead in Orion, are usually identified by their numbers in E. E. Barnard's catalogue.

IMAGES AND SUCH

The apparent surface brightness of an extended object in the focal plane of a telescope depends on the image scale. A telescope magnifying 100 times will yield an image only a quarter as bright as a 50-power instrument of the same aperture. However, if the contrast between a small object and the sky is very slight, increased magnification may aid detection.

If the telescopic image becomes too small, the eye will respond as if the object were a point source like a star. In this case, the diameter of the telescope will determine the intensity of the image.

SKY CONSIDERATIONS

The earth's atmosphere affects the performance of any telescope. Two properties are particularly important.

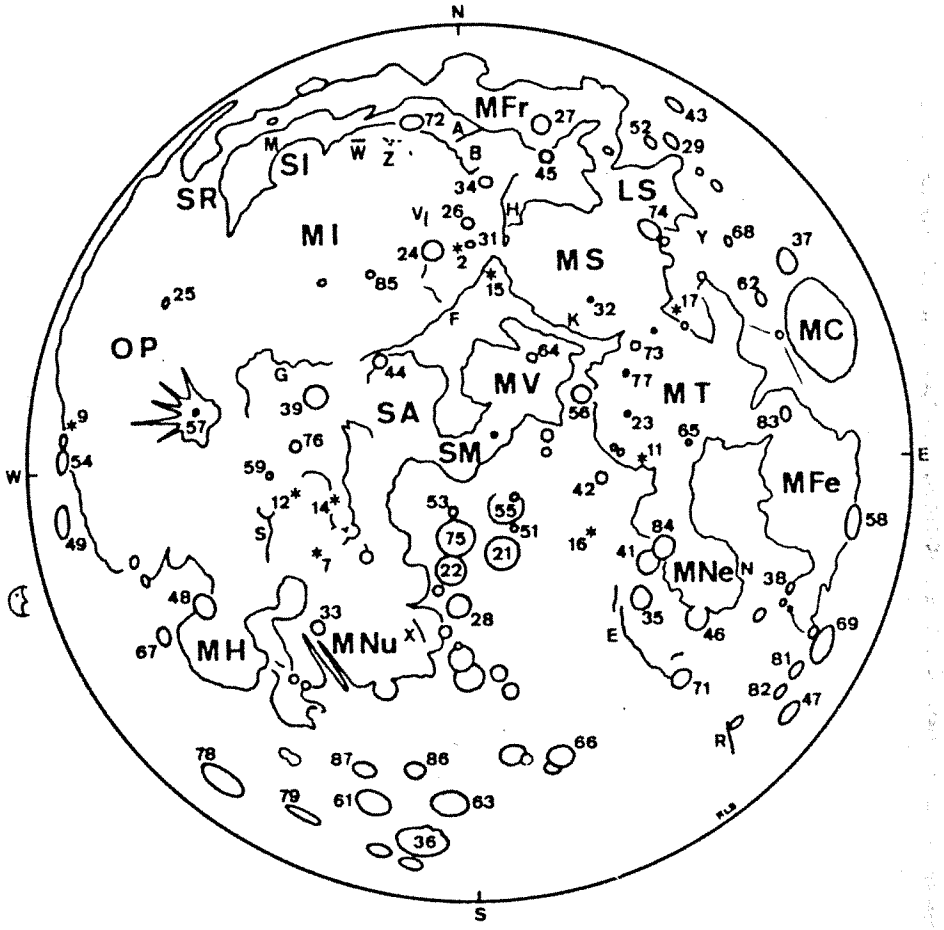
Seeing refers to the steadiness of the atmosphere, and it comes in two varieties: scintillation (twinkling) and slow (lateral image motion). To visual observers, the first type is the worst villain. With bad scintillation, the stars blow up in size, and the faintest ones vanish; also, fine detail becomes blurred. The slow pattern merely moves objects around the field. All seeing arises from atmospheric turbulence, when layers or pockets of hot and cold air intermingle. These disturbances may be created at ground level, inside your telescope tube, or thousands of feet in the atmosphere.

Transparency, on the other hand, describes the clarity of the atmosphere. As the transparency worsens, faint stars begin to disappear. Extended objects such as nebulae suffer most from poor transparency, lunar and planetary detail from poor seeing, star clusters equally from both effects.

TIPS FOR OBSERVERS

Atlases. Whether you use setting circles or a finder to locate objects, you invite trouble if you don't have star charts that go to 9th magnitude. Setting circles on amateur telescopes are rarely so accurate that no sweeping is needed to locate the target. For planets and bright stars this presents no problem, but it is a different story for faint objects. As one sweeps, by moving the telescope in some pattern, at least a magnitude is lost, and an object may be missed.

It is far better to use star charts, so that you know exactly where your subject is, and then use whatever techniques are necessary to ferret it out. Charts going to 9th magnitude or fainter will usually provide at least two stars for reference in the field of a low-power eyepiece. A 9th-



MAP OF THE MOON

Taken from THE OBSERVER'S HANDBOOK - 1986

MOON

KEY TO THE MAP OF THE MOON

CRATERS

21—Albategnius
22—Alphonsus
23—Arago
24—Archimedes
25—Aristarchus
26—Aristillus
27—Aristoteles
28—Arzachel
29—Atlas
31—Autolycus
32—Bessel
33—Bullialdus
34—Cassini
35—Catharina
36—Clavius
37—Cleomedes
38—Cook
39—Copernicus
41—Cyrillus
42—Delambre
43—Endymion
44—Eratosthenes
45—Eudoxus
46—Fracastorius
47—Furnerius
48—Gassendi
49—Grimaldi
51—Halley
52—Hercules
53—Herschel
54—Hevelius
55—Hipparchus
56—Julius Caesar
57—Kepler
58—Langrenus
59—Lansberg
61—Longomontanus
62—Macrobius
63—Maginus
64—Manilius
65—Maskelyne
66—Maurolycus
67—Mersenius
68—Newcomb
69—Petavius
71—Piccolomini
72—Plato
73—Plinius
74—Posidonius
75—Ptolemaeus
76—Reinhold
77—Ross
78—Schickard
79—Schiller
81—Snellius
82—Stevinus
83—Taruntius
84—Theophilus
85—Timocharis
86—Tycho
87—Wilhelm

MOUNTAINS

A —Alpine Valley
B —Alps Mts.
E —Altai Mts.
F —Apennine Mts.
G —Carpathian Mts.
H —Caucasus Mts.
K —Haemus Mts.
M—Jura Mts.
N —Pyrenees Mts.
R —Rheita Valley
S —Riphaeus Mts.
V —Spitzbergen
W—Straight Range
X —Straight Wall
Y —Taurus Mts.
Z —Teneriffe Mts.

MARIA

LS —Lacus Somniorum (Lake of Dreams)
MC —Mare Crisium (Sea of Crises)
MFe —Mare Fecunditatis (Sea of Fertility)
MFr —Mare Frigoris (Sea of Cold)
MH —Mare Humorum (Sea of Moisture)
MI —Mare Imbrium (Sea of Rains)
MNe—Mare Nectaris (Sea of Nectar)
MNu—Mare Nubium (Sea of Clouds)
MS —Mare Serenitatis (Sea of Serenity)
MT —Mare Tranquillitatis (Sea of Tranquillity)
MV —Mare Vaporum (Sea of Vapors)
OP —Oceanus Procellarum (Ocean of Storms)
SA —Sinus Aestuum (Seething Bay)
SI —Sinus Iridum (Bay of Rainbows)
SM —Sinus Medii (Central Bay)
SR —Sinus Roris (Bay of Dew)

LUNAR PROBES

2—Luna 2, First to reach Moon (1959·9·13)
7—Ranger 7, First close pictures (1964·7·31)
9—Luna 9, First soft landing (1966·2·3)
11—Apollo 11, First men on Moon (1969·7·20)
12—Apollo 12 (1969·11·19)
14—Apollo 14 (1971·2·5)
15—Apollo 15 (1971·7·30)
16—Apollo 16 (1972·4·21)
17—Apollo 17 (1972·12·11)

45. NGC 6822. In 1884 E. E. Barnard discovered this irregular dwarf galaxy with a 5-inch refractor. This member of the Local Group is the only dwarf that amateurs have much chance of seeing. Nevertheless, it is a rather difficult object, for its substantial total light is spread out over a large area.

Like M33, NGC 6822 is often visible in finders but difficult in a 10-inch. However, many years ago I saw it as bright and easy in the 36-inch reflector at Steward Observatory in Tucson, Arizona. In the hands of an amateur experienced with this type of object, an 8-inch at 40 power will usually ferret out NGC 6822.

46. NGC 6853. The appearance of the Dumbbell nebula changes dramatically with telescope aperture and magnification. Few people draw this planetary the same way; Admiral Smyth saw two ovals in contact, while John Mallas sketched a rough rectangle. Since the Dumbbell is so readily visible, many amateurs forget to use averted vision to improve the view markedly.

47. NGC 6960-2. For amateurs the Veil nebula has caused both despair and rejoicing. Its two long arcs of faint nebulosity, marking the edge of an old supernova bubble, are very difficult to pick up in a 6-inch f/4, but a 12-inch of the same focal ratio will show them easily during casual sweeping. Of the two arcs, the western one is the easiest to find as it is involved with the double star 52 Cygni. On an exceptional night some patches can be glimpsed between the arcs.

48. NGC 7009. In a 4-inch telescope the Saturn nebula appears as a bright greenish disk without structure. The "ears" that are so apparent on photographs cannot be seen in amateur instruments. This planetary bears magnification well, and a 12-inch at 200 power gives an exciting image.

49. NGC 7078. M15 lies in the same field as a 6th-magnitude star and is nearly as large and bright as M13. This globular cluster is notable for long strings of stars that can be resolved around its fringes. My 4-inch at 100 power shows them well.

50. NGC 7098. M2 is just below naked-eye visibility for most people, though it is readily seen in binoculars. This globular cannot be resolved by my 4-inch, which shows a brightening toward the center. With a 10-inch in Louisiana, stars were detected across the entire disk of M2.

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OBSERVING EARTHSHINE

by Michael Watson

The most casual observer of the skies frequently sees the unilluminated portion of the crescent moon faintly lit by sunlight reflected from the Earth. This phenomenon used to be known by the quaint expression, "the new moon in the old moon's arms" and today is known simply as earthshine. Earthshine is strongest at new moon, when the earth is fully and brilliantly lit by the sun, reflecting many times the amount of sunlight onto the dark side of the moon as the latter does onto the Earth at full moon.

As the moon orbits the earth and becomes a crescent, then first quarter, then gibbous, the sunlit portion of the Earth (as seen from the moon) decreases correspondingly until, at full moon, the Earth is completely darkened, lying as it does exactly between the moon and the sun.

Conventional wisdom has it that an earthbound observer can see earthshine on the moon until a day or so past first quarter. At that point, glare from the increasingly bright surface of the moon, together with the decreasing intensity of the earthshine itself, makes it difficult visually to detect earthshine on the moon.

It was with considerable interest, therefore, that I observed very strong earthshine on the evening of April 10/11, two days past first quarter. I was using a Meade 25 cm (10-inch) Schmidt-Cassegrain with a 40mm eyepiece giving 62 power, in very clear skies in midtown Toronto. The lunar maria and mountain highlands near the east limb were readily distinguishable, even though at that point the moon's elongation (i.e., position in its orbit around the Earth) was 116°, and fully 72% of its surface was sunlit.

The high pressure zone held, and the next night was just as clear. To my astonishment, at about 23:00 EST I again detected quite strong earthshine on the very narrow unilluminated crescent of the gibbous moon. The lunar elongation was 130°, so that 82% of the moon was sunlit, and barely 18% was dark. I have never before heard of an observation of earthshine made when the moon was so greatly illuminated, although I must think that many other amateurs have seen such a thing before.

Springtime is best for observing earthshine on the waxing gibbous moon, because of the high northern declination of the moon as well as the relative lack of the summertime atmospheric water vapour which tends to reduce contrast. Very clean optics and low magnification are also essential. Earthshine on the waning gibbous moon can most readily be detected in the months of October and November, although the weather in November rarely co-operates.

The elongation of the moon at any time can be determined from lunar occultation tables in the Observer's Handbook. The sunlit fraction of the moon is calculated from the following formula, where L is the degree of illumination and x is the elongation of the moon:

$$L = .5\ (1 - \sin\ (90 - x))$$

23. NGC 3587. In contrast, the Owl nebula is just visible in a 4-inch as a pale gray oval. For most observers, a 6-inch is needed to detect the "eyes," and larger telescopes may reveal some stars against the nebulosity.

24. NGC 4258. M106 is so bright that even a 2-inch yields interesting views. Larger apertures do not add much detail to the oblong patch with one squared-off end. A 6-inch, however, will also show NGC 4217, an 11th-magnitude 4′-by-1′ spiral 35′ to the southwest.

25. NGC 4565. This edge-on spiral is one of the most striking objects in the sky, and its appearance reminds me of M82. Just perceptible in a 3-inch, the galaxy can be traced out to 15′ with a 10-inch or larger instrument, which will also show the central bulge.

26. NGC 4594. M104 is the famous Sombrero galaxy, an edge-on spiral with a marked central bulge and conspicuous dark rim of dust. In a 16-inch this band cuts the bulge into two parts, but in smaller instruments the rim is evident only as a slight darkening across the northern part of the galaxy's disk. This effect has been noticed with only a 4-inch aperture, but an excellent night is required.

27. NGC 4826. Also known as M64 or the Black-eye galaxy, this spiral features an enormous patch of dust just to the east of its core. A 4-inch telescope at 80x has shown this patch to experienced observers, but most amateurs will need a 6-inch or larger.

28. NGC 5139. The great southern-hemisphere globular Omega Centauri surpasses any other. From mid-northern latitudes it just skirts the southern horizon, but even so, observers such as the late Harry Koken of Bird City, Kansas, regarded it as the best of its class. As seen from Guatemala it is an inspiring sight and obviously a cluster even to the naked eye. In the 6-inch refractor of Oaxaca Observatory in southern Mexico, Omega Centauri was the most amazing ball of stars one could dream of.

29. NGC 5194. The Whirlpool galaxy, M51, is situated 3° southwest of Eta Ursae Majoris, the end star in the handle of the Big Dipper. Both M51 and its 8th-magnitude companion are easy in a 3-inch telescope, and a 10-inch will reveal some spiral structure under good conditions. A greater challenge is to pick out the faint wisps of nebulosity that connect the two objects, which I have done with an 8-inch from the Empire Mountains of Arizona. A short-focus 12-inch is a more suitable instrument, however.

An 8-inch telescope can often show a faint star, perhaps magnitude 12, just southwest of M51's nucleus. Although sometimes mistaken for a supernova, the star is actually a foreground object in our own galaxy.

30. NGC 5272. M3 lies in a star-poor area of sky, which makes it relatively difficult to locate. This probably explains why it is less well known than M13, although many observers consider it a superior sight. Unlike many globulars, M3 can be resolved practically to its center.

31. NGC 5904. M5 is another globular that should have more fans. From the southern Mexican town of Puerto Angel, I saw it shining brilliantly with my naked eye, in a sky where Serpens is as striking as Cygnus is from Kansas. With my 10-inch telescope, I once viewed about 300 stars in the field of M5.

32. NGC 5907. Few spirals are as elongated as the Splinter galaxy, which is almost exactly edge on. To appreciate this sight, use a 10-inch telescope or larger, and be sure to plot the galaxy's position on a detailed star atlas, for it is easily missed when sweeping. I have had good results using powers of 100 to 150.

33. NGC 6121. M4, nestled near the ruby blaze of Antares, is one of the great globulars in the sky, but to see it with the naked eye from North America requires perfect conditions. As a child I found this object with my 1-inch 40-power telescope; a half-century later I still marveled at it as seen in a 4-inch rich-field reflector from Pyramid I at Tikal, Guatemala.

34. NGC 6205. M13 is the finest globular in the northern half of the sky. It is just visible to the naked eye along the western side of the Keystone of Hercules. A worthwhile experience is to examine this great object first with binoculars and then with larger and larger telescopes. In a 16-inch it is a fantastic swarm of stars, many in chains that curve from the center to the edge.

35. NGC 6254. Lying just west of the 5th-magnitude star 30 Ophiuchi, M10 is easy to find. In a 4-inch the texture of this globular is grainy, and a 10-inch in good skies readily resolves stars across the entire disk.

36. NGC 6523. The famous Lagoon nebula is one of the few great gas clouds available to amateurs. This vast complex of bright and dark nebulosity is full of swirls, though its appearance is very unlike that of the Orion nebula. The dark lane that crosses the center of M8 is responsible for its popular name. This lane is sometimes invisible in a 3-inch, though a 5-inch is always adequate. A sparse open cluster of about 25 stars lies near the eastern edge of the nebulosity.

37. NGC 6543. Using an 8-inch telescope, an observer will see a bright blue-green ring surrounding an 11th-magnitude central star. This planetary is just visible in a 3-inch.

38. NGC 6572. The surface brightness of this gem of a planetary is about a hundred times more than that of the Ring nebula in Lyra. Because it is only 6″ in diameter, I suggest using a fairly large aperture and a magnification from 100 to 150.

39. NGC 6618. M17, otherwise called the Horseshoe or Omega nebula, lies in an extremely rich area of the Milky Way. Though this large gas cloud can be readily detected in binoculars, a 6-inch telescope is needed to see its hooked shape distinctly. With any instrument, use low power.

40. NGC 6705. The flying-duck cluster, M11, is one of the most interesting stellar assemblages in the sky. An imaginative observer can readily see its distinctive V shape, which Admiral Smyth likened to a flight of wild ducks. The richness of this dense open cluster increases with telescope size. Immediately to the north is a large area of dark nebulae that has been easily seen with a 12-inch telescope.

41. NGC 6720. Because of its distinctive smoke-ring appearance, which is visible in a 4-inch at 40 to 100 power, M57 is the showpiece of planetary nebulae, being rivaled only by M27. It is also very easy to locate, for it lies on a line between the conspicuous naked-eye stars Beta and Gamma Lyrae.

With the 12-inch f/17 Porter telescope at Stellafane, 350 power dims the ring just enough to show its pointed ends and long streamers. This instrument also revealed the central star as well as several others inside and along the ring.

42. Collinder 399. This large, sparse naked-eye cluster with a curious coat-hanger shape was not officially recognized until 1931. Yet even in the 1920's it was known as Brocchi's cluster, after the American amateur who drew up most of the AAVSO star charts.

Several times every year this cluster is rediscovered by amateurs, especially the younger ones, but few of them notice another, much smaller open cluster on its eastern edge. Though having a total light only equivalent to an 11th-magnitude star, NGC 6802 appears as a delightful swarm of silver bees some 3½′ in diameter. In a 3-inch telescope it can be mistaken for a small comet.

43. NGC 6809. M55 is a splendid large globular which becomes more magnificent when viewed from more southerly latitudes than Connecticut, where a 3-inch at 30 power shows only a hazy patch. On nights of exceptional transparency, it was well worth viewing with a 10-inch from Kansas. From Yucatan, it rivaled M13 in my 4-inch.

44. NGC 6818. The featureless disk of this small green planetary is easily identified with a 4-inch at 60 power. It serves as a good starting point when you seek Barnard's galaxy, which lies about ⅔° to the southeast.

4. NGC 650-1. Leland S. Copeland dubbed M76 the "Little Dumbbell" because of the lobed shape of this large planetary. Though it can be well seen in a 4-inch, my best view was with a short-focus 12-inch on an average night. Medium power works well for M76, and at 150x it glowed vividly, with many delicate filaments stretching out from the edge of the main ball.

5. NGC 1039. In small rich-field telescopes M34 appears as a fine sprinkling of stars, but larger instruments make it a much more rewarding object. Depending on the aperture used, the diameter of this open cluster will vary from 15′ to 30′.

6. The Pleiades. Here is one of the best naked-eye and binocular objects in the heavens. Its brightest stars form a tiny dipper, causing many people to believe erroneously that the Pleiades star cluster is also the Little Dipper. Telescopically, M45 contains several hundred members, most of which lie within a degree of 2.9-magnitude Alcyone, the brightest Pleiad.

The entire cluster is embedded in nebulosity, which is strikingly revealed in long-exposure photographs. To view this illuminated dust visually requires care, to suppress the dazzling light of nearby stars. Usually, only the brightest patch, south of Merope, can be seen, but with a 6-inch telescope in the clear desert sky of Arizona, I have seen the curdled nebula extend across the whole field.

The 19th-century German observer H. d'Arrest commented that the nebulosity around M45 was invisible or barely glimpsed in large telescopes while it was easy in their finders. Thus, it is best viewed with low magnification. Years ago, I made a photographic mask, which was placed at the field stop of my finder eyepiece to block the bright cluster stars. The finder field then became filled with nebulosity. Some amateurs claim to have seen the nebula with their naked eye, and I am inclined to agree with them.

7. The Hyades. The brightest members of this open cluster form the familiar V-shaped head of Taurus the Bull (the 1st-magnitude star Aldebaran, however, is not a cluster member). For best viewing, use a good pair of binoculars, which will also nicely separate the wide double stars Theta and Sigma Tauri.

8. IC 434. This faint nebula stretches south of Zeta Orionis for almost a degree. At its midpoint lies the famous Horsehead nebula, a patch of dark obscuring matter seen in silhouette. Remember, the Horsehead is small, only 4′ or so across; many amateurs fail to find it because they are looking for something too big. Leslie Peltier saw it with a 6-inch refractor, and a 10-inch will usually suffice. However, a 12- or 16-inch telescope is needed for a superior view. Use medium power.

9. NGC 1952. The discovery of this nebula in 1758 prompted Charles Messier to compile his celebrated catalogue. It is the remnant of a supernova that exploded in 1054. M1 appears as a round blue glow in small telescopes, but an 8-inch or larger can show some traces of internal structure. Richard Wilds from Topeka, Kansas, has glimpsed the Crab nebula in 35-mm binoculars, and in truly dark skies it is always visible in a finder.

10. NGC 1976-82. The Great Nebula in Orion is the most magnificent celestial object available to visual observers. Greenish wreaths of gas are accented by dark lanes of obscuring dust. The Orion nebula is visible to the naked eye as a blur around the 4th-magnitude star Theta Orionis, which is actually a multiple system that includes the famous Trapezium. My finest view of the Orion nebula was with a 10-inch f/8.5 reflector in Kansas. I used a special eyepiece; designed by Arthur Leonard, it had a four-inch focal length yielding 21x and a field lens four inches in diameter.

11. NGC 2099. Of the many splashy star clusters in Auriga, M37 is the loveliest by far. Dimly visible to the unaided eye on a dark night, this cluster glows pleasantly in binoculars and resolves into a cascade of stars in a 4-inch. In his *Cycle of Celestial Objects*, the granddaddy of modern observing guides, Admiral Smyth described the field as "being strewed as it were with sparkling gold-dust."

12. NGC 2168. M35 is one of the most beautiful open clusters, and most of its 150 or so stars are bright and spread evenly over a large area. Since there are relatively few faint stars, telescopes larger than 10 inches in aperture do not substantially improve the view.

Often unnoticed on the outer edge of M35 is NGC 2158, a compact but dim open cluster. The first time I noticed it, I thought it was a comet because of its unusual arrowhead shape. To see NGC 2158 well, a 10-inch or larger telescope is necessary.

13. NGC 2237-44. Here is a combination object: the large though very faint Rosette nebula and its sparse cluster of stars (NGC 2244). Though the cluster can be seen with the naked eye under good conditions, the nebula presents a challenge. Good binoculars reveal a formless glow of light surrounding the cluster. On the other hand, Rolf Meier and Fred Lossing report that it was easy in the 16-inch f/5 telescope of the old North Mountain Observatory at Ottawa, Canada. At 50 power the nebula looked double, and at 130x a bridge of light connected the two parts. These observers also point out that the Rosette is much fainter than the Helix nebula (NGC 7293) in Aquarius.

14. NGC 2392. In a 2-inch telescope this planetary appears quite starlike, but in a 4-inch its bright blue disk becomes apparent. In their booklet *The Finest Deep-Sky Objects*, J. Mullaney and W. McCall note that it is easily seen in a 6-inch telescope, but I think a 10-inch or larger at 100 power is necessary for a truly fine view.

15. NGC 2422. Only the southerly declination of this open cluster keeps it from a top spot on everyone's observing list. Nevertheless, M47 is visible to the naked eye, and in a 10-inch it is really impressive.

16. NGC 2438. Though conveniently located on the northeastern edge of the open cluster M46, this planetary is difficult to see in small telescopes. In 8- to 10-inch instruments, however, its pale green disk makes a pleasing contrast with the cluster stars.

17. NGC 2440. Because of the lack of nearby stars, this planetary is difficult to find. Leland S. Copeland recommended at least an 8-inch aperture; 12 inches will give better results. However, on one superb night I once picked this object up in my 4-inch refractor.

18. NGC 2632. M44, the famous Praesepe cluster, is visible to the naked eye as a fuzzy patch boxed in by four faint stars. Binoculars will reveal about two-score stars, and a small telescope will show many of their colors.

19. NGC 3031. M81 is a bright spiral galaxy that appears about twice the size of M82, which can be seen in the same low-power field some 38′ to the north. In a 10-inch telescope traces of dark lanes can be glimpsed.

20. NGC 3034. Even in a 4-inch telescope much detail can be seen on the disk of this irregular galaxy. My best view was with a 10-inch at a star party held by the Mount Tamalpais Astronomical Society of San Francisco, California. Sharp-edged dark knots were scattered across the long narrow spindle and gave an illusion of continuous motion.

21. NGC 3227. This peculiar spiral galaxy is easily located, for it lies only 50′ east of Gamma Leonis, and is within easy reach of my 4-inch refractor at 95 power. Almost touching its disk is an elliptical galaxy, NGC 3226, which is about 1′ in diameter and of visual magnitude 11.

22. NGC 3242. This is one of the brightest and easiest planetaries to find, for it stands out in an otherwise rather empty sky. Its pale bluish disk has a surface brightness about eight times greater than the celebrated Ring nebula in Lyra and bears magnifications up to 200. A 6-inch telescope will easily show the 11th-magnitude central star.

50 Celestial Splendors To View

WALTER SCOTT HOUSTON, *East Haddam, Connecticut*

THE PREVIOUS INSTALLMENT described the kinds of celestial objects an amateur can see and gave some tips for viewing them. To sharpen your observing skills, I now offer a selection of 50 deep-sky splendors. Though many amateurs may have other favorites, this mix is intended to provide enjoyment and challenge for binocular buffs on up to users of 16-inch telescopes and larger.

These objects are listed in the accompanying table in order of increasing right ascension. Given first is the number in the *New General Catalogue* (*NGC*), or its supplemental *Index Catalogue* (*IC*), or the catalogue by P. Collinder; two naked-eye clusters are called by their popular names. The next column describes each object and gives its Messier number, if applicable. In the next column is the location of the object in 1950 coordinates. Finally, the total visual magnitude is given where appropriate (see the previous installment for cautions) and approximate angular dimensions. The size actually seen will vary with the instrument used.

1. NGC 224. The great Andromeda galaxy can be readily examined with the naked eye or with telescopes of any size. Under exceptional conditions, careful and experienced observers using large binoculars have traced the length of this galaxy to over 5°. A 6-inch telescope will reveal a tiny starlike nucleus and perhaps traces of the spiral arms that are so conspicuous on photographs. With a 12-inch or larger telescope, several faint globular clusters surrounding this galaxy can be detected, provided their locations have been pinpointed from photographs.

Only 0°.6 to the south of M31, and visible in the same low-power field, lies its companion NGC 221 (M32). This 8th-magnitude elliptical galaxy is about 3′ in diameter and is superimposed on the dimly glowing disk of its huge neighbor. M32 is often confused with NGC 205, which is found 0°.7 northwest of M31's core. This 9th-magnitude galaxy is also elliptical, though with an elongated (10′ by 4′) disk. Both of these companion galaxies would be better known were they not upstaged by nearby M31.

2. NGC 253. This miniature version of the Andromeda galaxy is situated rather far south for Northern Hemisphere observers, but even at low altitudes it is a conspicuous sight. With a 12-inch telescope in Colorado, I was able to detect distinct dark lanes and mottling across its large disk. Though visible in a 4-inch, NGC 253 is best viewed with larger apertures.

3. NGC 598. In a very clear, dark sky M33 is easily seen with the unaided eye, and even under much poorer conditions it can be glimpsed in finders or binoculars. For example, with a tiny two-power camera viewfinder I easily saw M33, despite some interference from zodiacal light. But because of its large apparent size and correspondingly low surface brightness, it can be difficult in 4- to 10-inch telescopes unless very low power is used.

In a 16-inch beautiful spiral arms can be seen, as well as many bright knots from unresolved star clusters and nebulae (such as the huge H II region, NGC 604, near the northeast edge of the galaxy's disk). From Tucson, Arizona, Ronald Morales has seen a faint patch near the main disk of M33, resulting in an appearance similar to M51, the famous Whirlpool galaxy. With an 8-inch telescope I have also noticed this curious shape.

50 SELECTED DEEP-SKY SPLENDORS

No.	*Cat. No.*	*Type of Object*	*R.A. (1950)*	*Dec.*	*Total Mag.*	*Size*
1.	NGC 224	Spiral Galaxy (M31)	0h 40.0m	+41° 00′	4	2°.5 × 0°.8
2.	NGC 253	Spiral Galaxy	0 45.1	−25 34	8.9	24′ × 6′
3.	NGC 598	Spiral Galaxy (M33)	1 31.1	+30 24	5.3	1°.0 × 0°.6
4.	NGC 650-1	Planetary Nebula (M76)	1 38.8	+51 19	9.6	1′.5 × 0′.7
5.	NGC 1039	Open Cluster (M34)	2 38.8	+42 34	5.9	30′
6.	Pleiades	Open Cluster (M45)	3 43.9	+23 58	1.4	1°.7
7.	Hyades	Open Cluster	4 16.7	+15 31	—	5°.5
8.	IC 434	Diffuse Nebula	5 38.6	−2 26	—	1°.0 × 0°.2
9.	NGC 1952	Supernova Remnant (M1)	5 31.5	+21 59	8.4	6′ × 4′
10.	NGC 1976-82	Diffuse Nebula (M42-43)	5 33.0	−5 22	4	1°.0
11.	NGC 2099	Open Cluster (M37)	5h 49.0m	+32° 33′	6.2	20′
12.	NGC 2168	Open Cluster (M35)	6 05.7	+24 20	5.3	30′
13.	NGC 2237-44	Diffuse Nebula	6 29.7	+4 54	6.2	1°.0
14.	NGC 2392	Planetary Nebula	7 26.2	+21 01	8.3	0′.7
15.	NGC 2422	Open Cluster (M47)	7 34.3	−14 22	4.6	25′
16.	NGC 2438	Planetary Nebula	7 39.6	−14 36	11.3	1′.1
17.	NGC 2440	Planetary Nebula	7 39.9	−18 05	11.7	0′.9 × 0′.3
18.	NGC 2632	Open Cluster (M44)	8 37.5	+19 52	4.5	1°.5
19.	NGC 3031	Spiral Galaxy (M81)	9 51.5	+69 18	7.9	21′ × 10′
20.	NGC 3034	Irregular Galaxy (M82)	9 51.9	+69 56	8.8	9′ × 4′
21.	NGC 3227	Spiral Galaxy	10h 20.7m	+20° 07′	10.2	4′ × 2′
22.	NGC 3242	Planetary Nebula	10 22.4	−18 23	8.2	0′.7 × 0′.6
23.	NGC 3587	Planetary Nebula (M97)	11 12.0	+55 18	9.5	3′
24.	NGC 4258	Spiral Galaxy (M106)	12 16.5	+47 35	8.2	19′ × 8′
25.	NGC 4565	Spiral Galaxy	12 33.9	+26 16	9.0	15′ × 2′
26.	NGC 4594	Spiral Galaxy (M104)	12 37.3	−11 21	7.9	6′ × 2′
27.	NGC 4826	Spiral Galaxy (M64)	12 54.3	+21 57	8.4	6′ × 3′
28.	NGC 5139	Globular Cluster (ω Cen)	13 23.8	−47 13	3.7	23′
29.	NGC 5194-5	Spiral Galaxy (M51)	13 27.8	+47 27	8.1	11′ × 7′
30.	NGC 5272	Globular Cluster (M3)	13 39.9	+28 38	6.4	10′
31.	NGC 5904	Globular Cluster (M5)	15h 16.0m	+2° 16′	6.9	12′
32.	NGC 5907	Spiral Galaxy	15 14.6	+56 31	10.3	12′ × 1′
33.	NGC 6121	Globular Cluster (M4)	16 20.6	−26 24	7.0	14′
34.	NGC 6205	Globular Cluster (M13)	16 39.9	+36 33	6.1	12′
35.	NGC 6254	Globular Cluster (M10)	16 54.5	−4 02	7.2	8′
36.	NGC 6523	Diffuse Nebula (M8)	18 01.6	−24 20	5	1°.0 × 0°.6
37.	NGC 6543	Planetary Nebula	17 58.8	+66 38	8.8	22′
38.	NGC 6572	Planetary Nebula	18 09.7	+6 50	9.6	0′.3 × 0′.2
39.	NGC 6618	Diffuse Nebula (M17)	18 17.9	−16 12	7.1	46′ × 37′
40.	NGC 6705	Open Cluster (M11)	18 48.4	−6 20	6.5	12′
41.	NGC 6720	Planetary Nebula (M57)	18h 51.7m	+32° 58′	9.3	1′.2 × 1′.0
42.	Col 399	Open Cluster	19 23.2	+20 05	4.8	1°.0
43.	NGC 6809	Globular Cluster (M55)	19 36.9	−31 03	6.9	15′
44.	NGC 6818	Planetary Nebula	19 41.1	−14 17	9.9	0′.4 × 0′.2
45.	NGC 6822	Irregular Galaxy	19 42.1	−14 53	8.6	16′ × 11′
46.	NGC 6853	Planetary Nebula (M27)	19 57.4	+22 35	7.6	8′ × 4′
47.	NGC 6960-2	Supernova Remnant	20 49.0	+31 00	—	2°.0
48.	NGC 7009	Planetary Nebula	21 01.4	−11 34	8.4	0′.7 × 0′.4
49.	NGC 7078	Globular Cluster (M15)	21 27.6	+11 57	7.0	12′
50.	NGC 7089	Globular Cluster (M2)	21 30.9	−1 03	7.3	12′

SKY NOTES

STEINBACH AND LANDMARK turned out to be 2 very sucessfull Comet Halley Sky Watch Sessions. They were attended by about 3000 and 400 people respectively I would like to thank all those individuals who assisted at the display and manning the telescopes. It is volunteers at these events which will help us buildup the membership within our Centre. THANKS AGAIN.
Any members who would also like to assist should leave their names and phone numbers with either Guy Westcott or Stan Runge at the next meeting. The dates for these events are not certain so we will have to contact you.

MONTHLY STAR PARTY - We will be continuing to arrange a monthly star party every month. These are held in conjunction with the MAS and the University. Dates are shown in the Calender page and we go dependent on the weather (we're 2 for 2 so far). This allows new members to attend the observatory. Guests are welcome.

GREY CUP POOL - This year's Grey Cup Pool provided us with about $175 to go towards the placing of a new dome at the observatory. A BIG THANKS goes to Fund Raising Chairman, Dave Trimble, for all the work he put into making it a success.

COMET HALLEY HATS ? - Yes and we sell them. Guy Westcott has designed a great insignia for the caps which sell for $ 6.00 each. We will have them available at our meetings.

TELESCOPE FOR SALE - Celestron C-5 with 4 eyepieces, porro prism, star diagonal, and other accessories. Complete package in new condition, asking $1000. Call Ray Bakaluk in Selkirk at 1-482-7487.

PLANETARIUM SHOW - "THE COMET ADVENTURE" is being shown. Call 943-3142 for program details. Also "The Sky Show", a mini astronomy course is held every second Sunday of the month. Call the Planetarium for details.

THE GOOD BOOK - A good book that I have quoting articles from is "THE JOY OF 'GAZING - A PERSONAL GUIDE FOR A NEW OBSERVER" by David Levy. He wrote it as a fund raiser for the Montreal Centre, and I think it is a gem. I'll have it available for perusing at the November meeting. If a group of people want to order it we may get a volume discount or at least save on bulk postage. Cost is $6.00 and the address for those who cannot wait is R.A.S.C. Montreal Centre, P.O. Box 1752 - Station B, Montreal,P.Q. H3B 3L3.

MIRROR COATINGS - At the last meeting we identified an inexpensive telescope mirror recoating place. It is: ATM COATINGS, c/o Kevin Medlock, 15022 Broadway Terrace, Oakland, CA, 94611. Prices are 6"-$12; 8"-$16; 10"-$20; 12"-$24; Secondaries free with primary mirror; removal of old coat $3; and postage & insurance charges are extra. See Guy Westcott for more details about this (aluminum coatings with silicon monoxide over-coatings).

SKYLINE - A telephone to the stars... Sky & Telescope magazine has a free recorded message service giving a 3 minute update on the latest happenings in astronomy. I called to hear more about Comet Machholz. After 6 p.m. it only costs about 60 cents per minute or $ 1.80 per call for long distance charges. It's even cheaper on Sundays. Call 1-617-497-4168.

WINNIPEG CALENDAR

WINTER SCHEDULE

JAN 10 * GENERAL MEETING @ 8:30 p.m. - NEW MEMBERS NIGHT
Topic - A POTPORRI OF TOPICS TO INTRODUCE THE NEWER MEMBERS TO OUR CENTRE AND ASTRONOMY IN GENERAL
We are trying to put together a series of short presentations on various topics related to astronomy and our centre. These should include CONSTELLATIONS, TELESCOPE USE AND ALIGNMENT, HOW TO FIND THE OBSERVATORY, SETTING UP AN OBSERVING PROGRAM AND OTHERS. All new members should be there, all previous members are invited for information.

JAN 11 STAR PARTY AT GLENLEA - We'll meet just after dusk for a night of Observing if weather permits. Members are asked to bring their telescopes if they desire. Dress warm and see the article "The Winter Challenge". With the new moon on the 10th, we'll be able to try for some deep sky objects.

FEB 8 STAR PARTY AT GLENLEA - this day will be 1 day before new moon so if skies are clear, we will be able to do some viewing without Comet Halley interfering. Dress warmly and bring hot drinks. All members are invited and can bring along friends.

FEB 14 * GENERAL MEETING @ 8:30 p.m. - SPEAKER GUY WESTCOTT
Topic - COMETS
Guy will provide the talk he has been presenting to outside organizations. He will also include information on photographing Comet Halley, a timely discussion.

Mar 14 * GENERAL MEETING - Details in next WINNICENTRICS.

* MEETINGS ARE HELD IN ROOM 217 LOCKHART HALL AT THE UNIVERSITY OF WINNIPEG

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THIS ISSUE ... is considered the 1986 PROGRAM ISSUE. A large influx of newer members made me decide to give a few articles for their interest and benefit. Included are a few project for all members to attempt, including 50 of the best deep sky objects and how to view them. A hint from David Levy's book on observing suggested to try viewing a number of objects on the moon. I provided a copy of the list from the OBSERVER'S HANDBOOK, to be used as a checklist. Another project can be to view all the other planets and maybe try to watch their motion against the stars for a short period of time (say 3 months).
... Speaking of the OBSERVER'S HANDBOOK, check it out for the upcoming events. It has an excellent article by Terence Dickinson on TELESCOPIC PLANETARY OBSERVING. Other interesting articles include more deep sky objects to view by Alan Dyer, lists of favorite double stars, planetary satelites, galaxies plus more.
PICK A PROJECT or more and stick to it throughout the upcoming year, and give yourself an opportunity to learn the discipline and enjoyment of observing. Most of all....HAVE FUN.

The next issue of WINNICENTRICS will be a Photography Edition. Members are asked to send in articles and pictures taken recently.

Vol. 26 Nos. 1

WINNICENTRICS

January-February 1986

1985/86 COUNCIL

President	- Mr. Stan Runge	Councillors -	Mr. Tom Cairns
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Observatory Director - Mr. Lorence Mlodzinski (668-3974)

Winnicentrics Editor - Mr. Stan Runge - Send articles to me at 15 Albina Way, Winnipeg, R2R 1A5

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"WE NEED YOUR HELP !"

AS MOST OF YOU ARE AWARE THE 1986 GENERAL ASSEMBLY IS BEING HOSTED BY OUR CENTRE. DURING THIS TIME WE WILL BE NEEDING PEOPLE WITH CARS WHO WOULD BE WILLING TO SUPPLY SOME OF OUR TRANSPORT NEEDS.

THIS WOULD CONSIST OF VOLUNTEERS ORGANIZED IN A POOL THAT COULD BE CALLED UPON IN THE EVENT OF AN EMERGENCY, AND TO TRANSPORT SOME OF OUR VISITORS OUT TO GLENLEA.

IF YOU ARE INTERESTED IN ASSISTING PLEASE CONTACT ME AT 269-2878.

THANKYOU
JOHN W. HAINES
TOURS AND TRANSPORTATION

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WRONG MAILING ADDRESS TO ALL CENTRES OF THE R.A.S.C.

PLEASE NOTE THAT THE CORRECT MAILING ADDRESS FOR THE WINNIPEG CENTRE IS P.O.BOX 215 AND NOT P.O. BOX 174 AS IT WAS PREVIOUSLY.

IF WINNICENTRICS IS BEING SENT TO AN INCORRECT ADDRESS FOR YOUR CENTRE, THEN PLEASE SEND A CHANGE OF ADDRESS CARD AVAILABLE FROM THE LOCAL POST OFFICE. SEND IT TO ME, STAN RUNGE VIA THE ADDRESS SHOWN TO OUR CENTRE (It's free).

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NOTICE TO ALL CENTRE MEMBERS

WINTER TWO CAR RULE NOW IN EFFECT FOR USE OF THE OBSERVATORY