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Comet-Hunting in Southern Skies

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As in so many other departments of astronomy, the Southern Hemisphere lags behind the Northern in the matter of comet discoveries. Attention was recently drawn to this fact by Dr. Edgar Everhart (1967) in America, himself a successful comet hunter. In a study of over 300 long-period comets, he came to the conclusion that many "discoverable" comets must have been missed. "Australia, South America and Africa" he writes, "have lacked their Barnards, their Brookses and their Giacobinis."

The Barnard here mentioned, I must hasten to say, was the famous American astronomer E.E. Barnard who in his younger days, towards the end of the last century, discovered 16 comets in 11 years, and whose total reached 19. W.R. Brooks of New York found at least 22, and Michel Giacobini, another of the giants, distinguished himself by averaging only 80 hours per comet discovery, as against the normal 100 to 200 hours or more.

The full list of the Northern comet hunters is a formidable one; it includes the Frenchmen Messier, who found some 21 comets and compiled the famous catalogue of nebulous objects, and the redoubtable Pons, the all-time record-holder with no less than 37 comet discoveries to his credit. These individual achievements have not been matched by today's discoverers, but the North continues to hold the lead in no uncertain way.

As far as the South is concerned, South Africa is not without honour in the annals of comet-seeking. It is perhaps little known that the founder of our country, Jan van Riebeeck, as far back as 1652 recorded in his Journal in December of that year four careful observations of the great comet of Hevelius. If communications had been better in those times, van Riebeeck might well have been credited with the discovery of this comet.

It is in the years between 1920 and 1950 that the greatest successes were recorded in this country. During this period the discoverers include Reid, Skjellerup, Forbes, Ensor, Houghton, du Toit, van Gent, Johnson, Paraskevopoulos, de Kock and Bester. Many of these names have become household words in astronomical circles.

But it is a sad fact that in recent years South African amateurs have not contributed very much to the search for new comets or to the observation of known ones. How can we convince them that both these pursuits are necessary and desirable?

Why should amateurs search for comets? In the first place the contribution of the professional astronomer is of necessity confined mainly to photographic techniques, and the burden of visual searching falls on those who have the time for it and possess the small wide-angle instruments suitable for such work.

Regarding the necessity for comet discoveries, M.J. Hendrie (1962) puts the matter thus: "More powerful apparatus is available today for the study of comets and it is obviously important that a constant supply of objects should be found so that this may be used to good effect. Apart from studies of the physical behaviour of comets, orbital data are needed for statistical and dynamical analysis ... There is much that amateur observers can do towards increasing the number of objects for study.

Probably it is true to say that this work is more important today than it has ever been."

It cannot be denied, however, that great patience and stamina are required of the comet-hunter. So many things are against him. The likeliest places to discover comets -- near the horizons above the sun -- are also the places where there is the densest atmosphere with its mist and smoke, and where the twilight glow interferes. Many comets move quickly in such positions and may be lost before they can be confirmed. This has happened twice in my own experience.

Often at critical times cloudy conditions add to the observer's troubles; and city dwellers have their own special problems with smoke and lights.

For Southern observers there is the added fact that the Southern bulge of the ecliptic (the likeliest region in which to find a comet in the summer months) passes through the constellations Scorpio, Ophiuchus and Sagittarius, which contain a bewildering variety of comet-like objects. These are mostly globular clusters and all except the largest defy attempts to distinguish them from tailless comets. This relatively small area of sky contains about a third of all the comet-like objects visible with small telescopes south of the equator.

Searching for comets has been likened to hunting for a needle in a haystack. In actual fact it is for the most part like looking in a succession of haystacks for a needle that isn't there!

It is strange that traditionally the great amateur comet-hunters have been and are "lone wolves." Perhaps it is time to change this concept. The advantages of co-operation are so obvious that I believe we should do all in our power to encourage amateurs to share in cometary work. The sky could be "parcelled out" as is done with nova searches. Time-tables of watches could be arranged so that the burden does not fall heavily on a few individuals.

Through the tracking of artificial earth satellites during the last decade many amateurs have been introduced to "rich-field" telescopes and the fascinating new vistas they open up. With such an instrument everyone can serve an apprenticeship in getting to know the sky and learning to recognise the host of objects that masquerade as comets. This is ideal training for the comet-hunter. With such a telescope other amateur activities can also be carried on, such as the observation of variable stars and telescopic meteors, nova searches and the following of known comets.

The instrumental requirements are simple: short-focus telescopes of fairly wide aperture and low magnification are used. With a power of something like 20 diameters the field of view may be well over 2 degrees. Even the humble three-inch refractor can become quite a powerful tool in this work. In the "Amateur Astronomer's Handbook" J.B. Sidgwick states that small refractors, if properly designed, particularly excel in the low magnification range. The other favourite of the amateur, the 6-inch reflector, if of reasonably short focal length and used with a power of about 25, is more than adequate.

The emphasis is throughout on portable telescopes, preferably on alt-azimuth mountings. When searching for comets at a low altitude a movable instrument enables one to avoid at least some of the trees and other obstacles that may present themselves.

While visual work on comets has been emphasised, it is not suggested that photographic techniques should be neglected by those with suitable equipment.

Photographic work, while extremely valuable, brings its own problems. The obvious one is that even the best film sometimes shows flaws which can look remarkably like comets. The only safe way is to make two exposures of each area to be covered.

As an aid and encouragement to prospective comet hunters it should be mentioned that during the past few years valuable studies have been made which throw light on the incidence of comets and how best to go about discovering them. Mention has been made of Everhart's paper, a study of which is recommended. Examining the discovery positions of 337 long-period comets, the author concludes that most comets are first observable in the morning sky, where there is a pronounced tendency for the discovery positions to cluster near the sun. This confirms earlier studies of smaller groups of comets by Hendrie and Marsden.

The suggestion that it would pay observers to concentrate on morning sweeps seems also to be confirmed in a practical way by the successes of the Japanese in the pre-dawn sky. But for the comfort of those who cannot face the rigours of the very early morning it remains true, as has often been pointed out, that long-period comets can be discovered in almost any area of the night sky. The famous American amateur Leslie Peltier (author of the delightful book "Starlight Nights") has stated that he prefers to search in the very dark areas of the sky far from the sun. And seven comets have rewarded his efforts.

Dr. Brian Marsden (1967) has made a study of the Sungrazing comet group which includes some of the great comets of history and also two very close to the present time: Pereyra 1963V and the splendid Ikeya-Seki 1965VIII. It is expected that further members of this group will appear, and Marsden has drawn up a detailed search ephemeris. This is a perennial ephemeris for sungrazing comets within 50 days of perihelion at any time. 268 positions are given for the inward branches and 260 for the outward, and these may be permanently plotted on star charts with dates of search for each branch. Any observer armed with this information can make a search of the likely positions for any given day within a matter of minutes. Such a programme could easily be added to one's normal routine of observing.

The ephemeris is of particular interest to Southern observers, since almost all the plotted positions are south of the celestial equator, the most northerly declination being only $+12.5^{o}$. For the months of December and January the southern circumpolar area is criss-crossed with the lines of the inward and outward branches. A special effort of searching should be made at this time, especially by amateurs living in the more cloud-free areas. It may be mentioned that in December 1945 D. du Toit at Bloemfontein discovered a 7th magnitude comet in Triangulum Australe. It seems likely, but has not been conclusively proved, that this was a member of the sungrazing group.

As an aid to the recognition of comet-like objects in the Southern sky, and to help observers to eliminate them in comet searches, I have over the past five years compiled a list of 130 such objects visible south of the celestial equator. Nearly a hundred of these have been encountered under varying conditions in comet sweeps using a 5-inch short-focus refractor with a magnification of 21 diameters. The rest have been added, and duly observed with the same telescope, after consulting various sources, notably E.J. Hartung's first-rate book "Astronomical Objects for Southern Telescopes" which includes details of the appearance in telescopes of various apertures

of all but 16 of the 130 objects.

Magnitudes have not been given. The information available from various catalogues and handbooks is scanty, and in some cases the published figures differ by as much as three magnitudes. There is room for some photometric and photographic work to complete the picture.

There is, however, an indication of the brightness of the objects and whether they are extended or angularly small. Some are almost stellar in appearance. A few very bright objects have been included, perhaps unnecessarily, but it is surprising how easily even these can be mistaken for comets when seen at low altitudes and under poor conditions. (The same applies to some galactic clusters which are normally easily resolved into stars). It is remarkable that when the rest of the Large Magellanic Cloud is quite invisible in the early dawn or in moonlight the Great Looped Nebula, intensely bright, shines out like the head of a great comet complete with a slightly displaced stellar nucleus. (It may be mentioned here that the Magellanic Clouds should normally be avoided like the plague by anyone looking for comets. There are however, a few objects on the outskirts of the Clouds which are regularly encountered in comet sweeps, and these have been included in the list, if only as a warning to the observer of the perils that lie ahead of him!)

The intention is that the 130 listed objects should be suitably marked in the comet-hunter's star charts, if necessary using a colour code to indicate the five types of object: galactic clusters, globular clusters, diffuse nebulae, planetary nebulae and galaxies. To avoid confusion the comet-like objects must be clearly distinguishable in the charts. The popular star atlases show hundreds of nebulae and clusters with little or no indication of their appearance or brightness. Many are not visible at all in small telescopes. Some fairly bright ones are missing altogether. Of the 130 objects in the list, 31 do not appear in Norton's Atlas and 7 are not in the Skalnate Pleso "Atlas of the Heavens." Other observers may find further deficiencies, since the list is not necessarily exhaustive, especially in regard to the fainter objects.

No discourse on comet-searching for amateurs would be complete without a word of advice on how and where to "sweep" -- sweeping being the process whereby long overlapping strips of the sky are examined in the telescope. The text-books have a wealth of advice on the subject. The classical concept for the Southern Hemisphere is to search in the Western and South-Western sky as soon as it becomes dark after sunset and the Eastern and South-Eastern sky as long as it is still dark before sunrise -- and, as stated earlier, the Eastern sky has been found to be the more promising. The sky above the Southern horizon should be watched in the summer months.

There are many taboos, such as shunning the twilight regions, and the denser parts of the Milky Way, and avoiding moonlight at all costs. It has even been said that one should not sweep for comets unless the sky is bright with stars right down to the horizon. If all these injunctions were taken too literally some of us would never get started.

The experts' advice should by all means be followed, but not too slavishly. Comets have been discovered in quite recent times by breaking one or more of the text-book rules. If the town-dweller is bothered by murky horizons, he should search higher in the sky, even if it is right up to the zenith, and even if the Milky Way

obtrudes itself or the moon makes the task a little harder. For those who want to try their hand at comet-hunting, on however small a scale, the only final rule is to use every available opportunity when the sky is clear. It is perseverance that counts.

Coupled with the discovery of new comets, there is an important role for the amateur in using his equipment to observe the known comets that come within its range. Here again there is a need for Southern observers.

It is of particular value to be able to make good brightness estimates, and this is an art that should be cultivated. It is more difficult to gauge the brightness of extended objects than of stars, and for very accurate results photometry is required, but the magnitude estimates of experienced amateurs are by no means to be despised. Indeed, in many cases they are the only ones available to the statisticians. Briefly, the technique is to compare the extra-focal images of stars of known brightness with the appearance of the comet-head in the telescope. The star images are deliberately thrown out of focus until they match the remembered size of the comet-head, and a comparison is then made of the two extended images. The resulting estimate can only be an approximation but with a skilled observer it can be a useful one.

It has recently been pointed out that visual magnitude estimates of short-period comets, if made carefully by a number of observers, might help to clear up the problem of the secular fading of such comets. Observations of the Periodic Comet Tempel II in 1967, including magnitude estimates provided by amateurs, have convinced some researchers that there has been little secular fading of this comet since its discovery in 1873. This is contrary to predictions and as a result, theories on the subject may have to be re-examined. Periodic comets usually are very faint, and amateurs with small telescopes may have to wait some time before a bright one presents itself. The brightest periodic comet of 1969 reaches a predicted peak magnitude of only 9.7 in mid-September, and will be awkwardly situated in the morning sky.

The following of long-period comets is also of importance and can be most interesting. Even during the past ten years there has been a great variety in the comets visible to amateurs. In appearance they ranged from tiny blurred spots like the smaller globular clusters and seen only in the telescope, to the majestic naked-eye display of Ikeya-Seki in 1965 with its tail of 25 degrees and more. The periods of visibility also differed widely. The Humason comet discovered in 1961 was visible until the latter half of 1963. Others faded all too rapidly. Comets are full of surprises and seldom behave as predicted.

Who can tell what the years ahead may bring? The present lull may well betoken a new period of activity on the part of the comets. It is my earnest hope that some of our younger members will take up the challenge of purposefully searching the face of the skies with a zest that only youth can bring to the task. Whether they will find comets I do not know, but they will almost certainly come under the spell of what for some of us has been a life-long experience -- the tremendous fascination of the night sky.

May I conclude with the advice of Leslie Peltier to all comet-seekers. It is short and to the point: "Keep looking!"

COMET-LIKE OBJECTS SOUTH OF THE CELESTIAL EQUATOR

(As observed with a 5-inch short-focus refractor x21)

	Catalogue Nos.			(1950) R.A.		Dec.				Books/
No.	NGC	Messier	W. Herschel	h	m	o	'	Const.	Description	Class	Charts
1	55	-	-	0	12.5	-39	30	Scl	Galaxy (Nu)	B2	MHNS
2	104	-	-	0	21.8	-72	22	Tuc	Globular Cl.	A	WMHNS
3	247	-	20^5	0	44.5	-21	01	Cet	Galaxy	B4	MHS
4	253	-	1^5	0	45.1	-25	34	Scl	Galaxy	B2	WMHNS
5	288	-	20^6	0	50.3	-26	51	Scl	Globular Cl.	B1	WMHNS
6	300	-	-	0	52.7	-37	58	Scl	Galaxy	B3	HS
7	362	-	-	1	00.6	-71	07	Tuc	Globular Cl.	A	WMHNS
8	613	-	281^1	1	32.0	-29	40	Scl	Galaxy (Nu)	C2	WHNS
9	1068	77	-	2	40.1	- 0	13	Cet	Galaxy (Nu)	B1	WMHNS
10	1097	-	48^5	2	44.2	-30	29	For	Galaxy (Nu)	B4	WMHNS
11	1261	-	-	3	10.9	-55	24	Hor	Globular Cl.	B1	MHS
12	1291	-	-	3	15.5	-41	17	Eri	Galaxy	B1	MHNS
13	1313	-	-	3	17.6	-66	40	Ret	Galaxy	B4	MHS
14	1316	-	-	3	20.8	-37	24	For	Galaxy (Nu)	B1	WMHNS
15	1360	-	-	3	31.4	-26	00	For	Plan. Nebula	B1	H
16	1365	-	-	3	31.8	-36	18	For	Galaxy (Nu)	B1	WHNS
17	1380	-	-	3	34.6	-35	09	For	Galaxy	C2	HNS
18	1387	-	-	3	35.0	-35	41	For	Galaxy	C2	WNS
19	1399	-	-	3	36.6	-35	37	For	Galaxy	C2	WMHNS
20	1404	-	-	3	36.9	-35	45	Eri	Galaxy	C2	S
21	1433	-	-	3	40.5	-47	23	Hor	Galaxy (Nu)	B4	HS
22	1535	-	26^4	4	11.9	-12	52	Eri	Plan. Nebula	C1	WMHNS
23	1549	-	-	4	14.7	-55	42	Dor	Galaxy (Nu)	B1	MHS
24	1553	-	-	4	15.1	-55	54	Dor	Galaxy	B1	MHS
25	1566	-	-	4	18.9	-55	04	Dor	Galaxy (Nu)	B1	MHNS
26	1672	-	-	4	44.9	-59	20	Dor	Galaxy (Nu)	B1	HS
27	1763	-	-	4	56.7	-66	29	Dor	Diff. Nebula	B3	WHN
28	1783	-	-	4	59.0	-66	04	Dor	Globular Cl.	B1	-
29	1792	-	-	5	03.5	-38	04	Col	Galaxy	B4	MHNS
30	1818	-	-	5	04.2	-66	30	Dor	Globular Cl.	B1	WHN
31	1808	-	-	5	05.9	-37	34	Col	Galaxy (Nu)	B4	HS
32	1851	-	-	5	12.5	-40	06	Col	Globular Cl.	B1	WMHNS
33	1866	-	-	5	13.5	-65	31	Dor	Globular Cl.	B1	-
34	1904	79	-	5	22.1	-24	34	Lep	Globular Cl.	B1	WMHNS
35	2070	-	-	5	39.1	-69	08	Dor	Diff. Nebula	A	WMHNS
36	2214	-	-	6	13.2	-68	15	Dor	Globular Cl.	B1	-
37	2298	-	-	6	47.2	-35	57	Pup	Globular Cl.	C2	MHNS
38	2489	-	23^7	7	54.2	-29	56	Pup	Galactic Cl.	B3(R)	NS
39	2506	-	37^6	7	57.6	-10	29	Mon	Galactic Cl.	B4	WNS
40	2627	-	63^7	8	35.2	-29	47	Pyx	Galactic Cl.	B4	NS
41	2808	-	-	9	11.0	-64	39	Car	Globular Cl.	B1	WMHNS

No.	Catalogue Nos. NGC	Messier	W.Herschel	R.A. h	R.A. m	Dec. °	Dec. ′	Const.	Description	Class	Books/Charts
42	3115	-	163[1]	10	02.8	-07	28	Sex	Galaxy (Nu)	B1	WMHNS
43	3132	-	-	10	04.9	-40	11	Vel	Plan. Nebula	C1	WMHNS
44	3201	-	-	10	15.6	-46	09	Vel	Globular Cl.	B1(R)	MHNS
45	3242	-	27[4]	10	22.4	-18	23	Hya	Plan. Nebula	C1	WMHNS
46	3621	-	241[1]	11	15.9	-32	32	Hya	Galaxy	B1	MHNS
47	-	(Melotte 105)		11	17.4	-63	14	Car	Galactic Cl.	B1	MS
48	-	(Melotte 108)		11	48.4	-55	25	Cen	Galactic Cl.	B4(R)	S
49	3923	-	259[1]	11	48.5	-28	33	Hya	Galaxy	B4	NS
50	4372	-	-	12	22.9	-72	23	Mus	Globular Cl.	B4	MHS
51	4590	68	-	12	36.8	-26	29	Hya	Globular Cl.	B1	WMHNS
52	4594	104	43[1]	12	37.4	-11	21	Vir	Galaxy (Nu)	B1	WMHNS
53	4697	-	39[1]	12	46.0	-05	32	Vir	Galaxy (Nu)	B1	WMHNS
54	4699	-	129[1]	12	46.5	-08	24	Vir	Galaxy (Nu)	B1	WMNS
55	4753	-	16[1]	12	49.8	-00	55	Vir	Galaxy	B4	MS
56	4833	-	-	12	56.0	-70	36	Mus	Globular Cl.	B1	MHNS
57	4945	-	-	13	02.4	-49	01	Cen	Galaxy	B2	MHNS
58	4976	-	-	13	05.9	-49	14	Cen	Galaxy (Nu)	C2	HNS
59	5061	-	138[1]	13	15.4	-26	36	Hya	Galaxy (Nu)	C2	WHNS
60	5128	-	-	13	22.5	-42	46	Cen	Galaxy	B1	MHNS
61	5139	-	-	13	23.7	-47	03	Cen	Globular Cl.	A(!)	WMHNS
62	5189	-	-	13	29.9	-65	43	Mus	Plan. Nebula	C2	MHNS
63	5236	83	-	13	34.2	-29	37	Hya	Galaxy (Nu)	B1	MHNS
64	5286	-	-	13	43.3	-51	07	Cen	Globular Cl.	B1	MHNS
65	5617	-	-	14	26.0	-60	30	Cen	Galactic Cl.	B3(R)	MHNS
66	5634	-	70[1]	14	27.0	-05	45	Vir	Globular Cl.	B1	WMHNS
67	5824	-	-	15	00.9	-32	53	Lup	Globular Cl.	B1	MHS
68	5897	-	19[6]	15	14.5	-20	50	Lib	Globular Cl.	B1	WMHNS
69	5927	-	-	15	24.4	-50	30	Lup	Globular Cl.	B1	MHNS
70	5986	-	-	15	42.7	-37	37	Lup	Globular Cl.	B1	MHNS
71	5999	-	-	15	48.2	-56	20	Nor	Galactic Cl.	C2	HNS
72	6005	-	-	15	51.8	-57	18	Nor	Galactic Cl.	C2	S
73	6093	80	-	16	14.1	-22	51	Sco	Globular Cl.	B1	WMHNS
74	6101	-	-	16	20.0	-72	06	Aps	Globular Cl.	B4	MHNS
75	6121	4	-	16	20.6	-26	24	Sco	Globular Cl.	B1(R)	WMHNS
76	6134	-	-	16	24.0	-49	02	Nor	Galactic Cl.	B3(R)	HNS
77	6144	-	10[6]	16	24.2	-25	56	Sco	Globular Cl.	B4	MHS
78	6139	-	-	16	24.3	-38	44	Sco	Globular Cl.	B1	MHNS
79	6171	107	40[6]	16	29.7	-12	57	Oph	Globular Cl.	B1	WMHNS
80	6218	12	-	16	44.6	-01	52	Oph	Globular Cl.	B1	WMHNS
81	6216	-	-	16	45.8	-44	39	Sco	Galactic Cl.(?)	B4	-
82	6235	-	584[2]	16	50.4	-22	06	Oph	Globular Cl.	B1	HS
83	6254	10	-	16	54.5	-04	02	Oph	Globular Cl.	B1	WMHNS
84	6253	-	-	16	55.1	-52	38	Ara	Galactic Cl.	B3	S
85	6266	62	-	16	58.0	-30	03	Oph	Globular Cl.	B1	WMHNS

No.	Catalogue Nos. NGC	Messier.	W. Herschel	R.A. h m	Dec. o '	Const.	Description	Class	Books/ Charts
86	6273	19	-	16 59.5	-26 12	Oph	Globular Cl.	B1	WMHNS
87	6284	-	11^{6}	17 01.4	-24 42	Oph	Globular Cl.	B1	MHNS
88	6287	-	195^{2}	17 02.1	-22 39	Oph	Globular Cl.	B1	MHNS
89	6293	-	12^{6}	17 07.0	-26 21	Oph	Globular Cl.	B1	MHNS
90	6304	-	147^{1}	17 11.4	-29 24	Oph	Globular Cl.	B1	MHNS
91	6316	-	45^{1}	17 13.5	-28 05	Oph	Globular Cl.	B1	MHNS
92	6333	9	-	17 15.3	-18 28	Oph	Globular Cl.	B1	WMHNS
93	6356	-	48^{1}	17 20.7	-17 46	Oph	Globular Cl.	B1	MHNS
94	6352	-	-	17 21.6	-48 26	Ara	Globular Cl.	B1	MHS
95	6362	-	-	17 26.6	-67 01	Ara	Globular Cl.	B1	MHNS
96	6388	-	-	17 32.6	-44 43	Sco	Globular Cl.	B1	WMHNS
97	6402	14	-	17 35.0	-03 13	Oph	Globular Cl.	B1	WMHNS
98	6397	-	-	17 36.6	-53 39	Ara	Globular Cl.	B1(R)	MHNS
99	6441	-	-	17 46.8	-37 03	Sco	Globular Cl.	B1	WMHNS
100	6496	-	-	17 55.4	-44 15	CrA	Globular Cl.	B1	MHNS
101	6522	-	49^{1}	18 00.4	-30 03	Sgr	Globular Cl.	B1	HNS
102	6528	-	200^{2}	18 01.6	-30 04	Sgr	Globular Cl.	C2	HS
103	6544	-	-	18 04.3	-25 01	Sgr	Globular Cl.	B4	HS
104	6541	-	-	18 04.4	-43 44	CrA	Globular Cl.	B1	MHNS
105	6553	-	-	18 06.3	-25 56	Sgr	Globular Cl.	B1	MHS
106	6569	-	201^{2}	18 10.4	-31 50	Sgr	Globular Cl.	B1	MHS
107	6584	-	-	18 14.6	-52 14	Tel	Globular Cl.	B1	MHNS
108	6618	17	-	18 17.9	-16 12	Sgr	Diff. Nebula	B2	WMHNS
109	6624	-	50^{1}	18 20.5	-30 23	Sgr	Globular Cl.	B1	MHNS
110	6626	28	-	18 21.5	-24 54	Sgr	Globular Cl.	B1	WMHNS
111	6638	-	51^{1}	18 27.9	-25 32	Sgr	Globular Cl.	C2	MHNS
112	6637	69	-	18 28.1	-32 23	Sgr	Globular Cl.	B1	WMHNS
113	6652	-	-	18 32.5	-33 02	Sgr	Globular Cl.	B1	MHNS
114	6656	22	-	18 33.3	-23 57	Sgr	Globular Cl.	B1(R)	WMHNS
115	6681	70	-	18 40.0	-32 21	Sgr	Globular Cl.	B1	WMHNS
116	6705	11	-	18 48.4	-06 20	Sct	Galactic Cl.	B1	WMHNS
117	6712	-	47^{1}	18 50.4	-08 46	Sct	Globular Cl.	B1	WMHNS
118	6715	54	-	18 51.9	-30 32	Sgr	Globular Cl.	B1	WMHNS
119	6723	-	-	18 56.2	-36 42	Sgr	Globular Cl.	B1	MHNS
120	6744	-	-	19 05.0	-63 56	Pav	Galaxy	B4	HNS
121	6752	-	-	19 06.4	-60 04	Pav	Globular Cl.	B1(R)	MHNS
122	6809	55	-	19 36.9	-31 04	Sgr	Globular Cl.	B1	WMHNS
123	6818	-	51^{4}	19 41.1	-14 17	Sgr	Plan. Nebula	C2	WMHNS
124	6864	75	-	20 03.2	-22 04	Sgr	Globular Cl.	C1	WMHNS
125	6981	72	-	20 50.7	-12 44	Aqr	Globular Cl.	C2	MHNS
126	7009	-	1^{4}	21 01.4	-11 34	Aqr	Plan. Nebula	C1	WMHNS
127	7089	2	-	21 30.9	-01 03	Aqr	Globular Cl.	B1	WMHNS
128	7099	30	-	21 37.5	-23 25	Cap	Globular Cl.	B1	WMHNS
129	7293	-	-	22 27.0	-21 06	Aqr	Plan. Nebula	B4	MHS
130	7793	-	-	23 55.3	-32 51	Scl	Galaxy	B4	MHS

Notes

1. Classification:
   - A. Bright, well-known objects, presenting no difficulty except when near the horizon, or in moonlight, twilight or haze.
   - B. Extended objects: hazy spots, streaks or patches.
     1. Circular or slightly elliptical.
     2. Elongated.
     3. Irregular.
     4. Very faint, easily missed.
   - C. Angularly small objects, almost stellar, easily missed in sweeping.
     1. Bright (well seen).
     2. Faint (seen only with difficulty).
   - R. (Suffix): Fully or partly resolved into stars under a higher magnification, with a larger aperture, or in very good conditions.
   - Nu. Bright nucleus (of a galaxy).

   It should be noted that some of the objects are not truly comet-like, even under low magnification, unless conditions are second-rate. They have been included because such conditions all too often befall the comet-hunter.

2. Books in which the objects are listed, and star charts in which they appear:-
   - W - Webb, Rev. T.W.: "Celestial Objects for Common Telescopes." (Revised by Margaret Mayall, Dover Publications, 1962).
   - M - Menzel, D.H.: "A Field Guide to the Stars and Planets." (Collins, London, 1966).
   - H - Hartung, E.J.: "Astronomical Objects for Southern Telescopes." (Cambridge University Press, 1968).
   - N - Norton's Star Atlas and Telescopic Handbook.
   - S - Skalnate Pleso "Atlas of the Heavens." (Bečvář).

References

Everhart, E., 1967, Astron. J. 72, 716.
Hendrie, M.J., 1962, J. Brit. Astron. Assoc., 72, 384.
Marsden, B.G., 1967, Astron. J., 72, 1170.

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