MISCELLANEOUS ASTRONOMICAL DATA

UNITS OF LENGTH
1 Angstrom unit	$= 10^{-8}$ cm.
1 micron	$= 10^{-4}$ cm.
1 meter	$= 10^{2}$ cm. $= 3.28084$ feet
1 kilometer	$= 10^{5}$ cm. $= 0.62137$ miles
1 mile	$= 1.60935 \times 10^{5}$ cm. $= 1.60935$ km.
1 astronomical unit	$= 1.49504 \times 10^{13}$ cm. $= 92,897,416$ miles
1 light year	$= 9.463 \times 10^{17}$ cm. $= 5.880 \times 10^{12}$ miles $= 0.3069$ parsecs
1 parsec	$= 30.84 \times 10^{17}$ cm. $= 19.16 \times 10^{12}$ miles $= 3.259$ l.y.
1 megaparsec	$= 30.84 \times 10^{23}$ cm. $= 19.16 \times 10^{18}$ miles $= 3.259 \times 10^{6}$ l.y

UNITS OF TIME
Sidereal day $= 23h\ 56m\ 04.09s$ of mean solar time
Mean solar day $= 24h\ 03m\ 56.56s$ of sidereal time
Synodical month $= 29d\ 12h\ 44m$; sidereal month $= 27d\ 07h\ 43m$
Tropical year (ordinary) $= 365d\ 05h\ 48m\ 46s$
Sidereal year $= 365d\ 06h\ 09m\ 10s$
Eclipse year $= 346d\ 14h\ 53m$

THE EARTH
Equatorial radius, $a = 3963.35$ miles; flattening, $c = (a-b)/a = 1/297.0$
Polar radius, $b = 3950.01$ miles
$1°$ of latitude $= 69.057 - 0.349 \cos 2\phi$ miles (at latitude ϕ)
$1°$ of longitude $= 69.232 \cos \phi - 0.0584 \cos 3\phi$ miles

Mass of earth $= 6.6 \times 10^{21}$ tons; velocity of escape from $\bigoplus = 6.94$ miles/sec.

EARTH'S ORBITAL MOTION
Solar parallax $= 8.''80$; constant of aberration $= 20.''47$
Annual general precession $= 50.''26$; obliquity of ecliptic $= 23° 26' 50''$ (1939)
Orbital velocity $= 18.5$ miles/sec.; parabolic velocity at $\bigoplus = 26.2$ miles/sec

SOLAR MOTION
Solar apex, R.A. $18h\ 04m$; Dec. $+31°$
Solar velocity $= 12.2$ miles/sec.

THE GALACTIC SYSTEM
North pole of galactic plane R.A. $12h\ 40m$, Dec. $+28°$ (1900)
Centre. $325°$ galactic longitude, $=$ R.A. $17h\ 24m$, Dec. $-30°$
Distance to centre $= 10,000$ parsecs; diameter $= 30,000$ parsecs.
Rotational velocity (at sun) $= 262$ km./sec.
Rotational period (at sun) $= 2.2 \times 10^{8}$ years
Mass $= 2 \times 10^{11}$ solar masses

EXTRAGALACTIC NEBULAE
Red shift $= +530$ km./sec./megaparsec $= +101$ miles /sec./million l.y

RADIATION CONSTANTS
Velocity of light $= 299,774$ km./sec. $= 186,271$ miles/sec.
Solar constant $= 1.93$ gram calories/square cm./minute
Light ratio for one magnitude $= 2.512$; log ratio $= 0.4000$
Radiation from a star of zero apparent magnitude $= 3 \times 10^{-6}$ meter candles
Total energy emitted by a star of zero absolute magnitude $= 5 \times 10^{25}$ horsepower

MISCELLANEOUS
Constant of gravitation, $G = 6.670 \times 10^{-8}$ c.g.s. units
Mass of the electron, $m = 9.035 \times 10^{-28}$ gm.; mass of the proton $= 1.662 \times 10^{-24}$ gm
Planck's constant, $h = 6.55 \times 10^{-27}$ erg. sec.
Loschmidt's number $= 2.705 \times 10^{19}$ molecules/cu. cm. of gas at N.T.P.
Absolute temperature $= T° K = T°C + 273° = 5/9\ (T° F + 459°)$
1 radian $= 57°.2958$	$\pi = 3.141,592,653,6$
$= 3437'.75$	No. of square degrees in the sky
$= 206,265''$	$= 41.253$

1948 Observer's Handbook, Royal Astro. Society of Canada, 3 Wilcox Street, Toronto

THE CONSTELLATIONS

Latin and English Names with Abbreviations

Andromeda,		
(*Chained Maiden*) ...And	Andr	
Antlia, *Air Pump*......Ant	Antl	
Apus, *Bird of Paradise*..Aps	Apus	
Aquarius, *Water-bearer*..Aqr	Aqar	
Aquila, *Eagle*.........Aql	Aqil	
Ara, *Altar*............Ara	Arae	
Aries, *Ram*...........Ari	Arie	
Auriga, (*Charioteer*)....Aur	Auri	
Bootes, (*Herdsman*)....Boo	Boot	
Caelum, *Chisel*.......Cae	Cael	
Camelopardalis, *Giraffe*..Cam	Caml	
Cancer, *Crab*. ....Cnc	Canc	
Canes Venatici,		
Hunting Dogs.......CVn	CVen	
Canis Major, *Greater Dog*.CMa	CMaj	
Canis Minor, *Lesser Dog*.CMi	CMin	
Capricornus, *Sea-goat*...Cap	Capr	
Carina, *Keel*..........Car	Cari	
Cassiopeia,		
(*Lady in Chair*) ......Cas	Cass	
Centaurus, *Centaur*.....Cen	Cent	
Cepheus, (*King*).......Cep	Ceph	
Cetus, *Whale*..........Cet	Ceti	
Chamaeleon, *Chamaeleon*Cha	Cham	
Circinus, *Compasses*.....Cir	Circ	
Columba, *Dove*........Col	Colm	
Coma Berenices,		
Berenice's Hair.......Com	Coma	
Corona Australis,		
Southern Crown......CrA	CorA	
Corona Borealis.		
Northern Crown......CrB	CorB	
Corvus, *Crow*.........Crv	Corv	
Crater, *Cup*...........Crt	Crat	
Crux, (*Southern*) *Cross*..Cru	Cruc	
Cygnus, *Swan*.........Cvg	Cygn	
Delphinus, *Dolphin*.....Del	Dlph	
Dorado, *Swordfish*......Dor	Dora	
Draco, *Dragon*.........Dra	Drac	
Equuleus, *Little Horse*...Equ	Equl	
Eridanus, *River Eridanus*.Eri	Erid	
Fornax, *Furnace*........For	Forn	
Gemini, *Twins*.........Gem	Gemi	
Grus, *Crane*...........Gru	Grus	
Hercules,		
(*Kneeling Giant*) .....Her	Herc	
Horologium, *Clock*......Hor	Horo	
Hydra, *Water-snake*.....Hya	Hyda	
Hydrus, *Sea-serpent*.....Hyi	Hydi	
Indus, *Indian*.........Ind	Indi	
Lacerta, *Lizard*........Lac	Lacr	

Leo, *Lion*.............Leo	Leon	
Leo Minor, *Lesser Lion*..LMi	LMin	
Lepus, *Hare*...........Lep	Leps	
Libra, *Scales*..........Lib	Libr	
Lupus, *Wolf*..........Lup	Lupi	
Lynx, *Lynx*...........Lyn	Lync	
Lyra, *Lyre*............Lyr	Lyra	
Mensa, *Table* (*Mountain*)Men	Mens	
Microscopium,		
Microscope..........Mic	Micr	
Monoceros, *Unicorn*....Mon	Mono	
Musca, *Fly*...........Mus	Musc	
Norma, *Square*........Nor	Norm	
Octans, *Octant*........Oct	Octn	
Ophiuchus,		
Serpent-bearer.......Oph	Ophi	
Orion, (*Hunter*).......Ori	Orio	
Pavo, *Peacock*.........Pav	Pavo	
Pegasus, (*Winged Horse*)Peg	Pegs	
Perseus, (*Champion*)...Per	Pers	
Phoenix, *Phoenix*......Phe	Phoe	
Pictor, *Painter*........Pic	Pict	
Pisces, *Fishes*.........Psc	Pisc	
Piscis Australis,		
Southern Fish.......PsA	PscA	
Puppis, *Poop*.........Pup	Pupp	
Pyxis, *Compass*........Pyx	Pyxi	
Reticulum, *Net*........Ret	Reti	
Sagitta, *Arrow*........Sge	Sgte	
Sagittarius, *Archer*.....Sgr	Sgtr	
Scorpius, *Scorpion*.....Scr	Scor	
Sculptor, *Sculptor*......Scl	Scul	
Scutum, *Shield*........Sct	Scut	
Serpens, *Serpent*.......Ser	Serp	
Sextans, *Sextant*.......Sex	Sext	
Taurus, *Bull*..........Tau	Taur	
Telescopium, *Telescope*..Tel	Tele	
Triangulum, *Triangle*...Tri	Tria	
Triangulum Australe,		
Southern Triangle.....TrA	TrAu	
Tucana, *Toucan*.......Tuc	Tucn	
Ursa Major, *Greater Bear*.UMa	UMaj	
Ursa Minor, *Lesser Bear*.UMi	UMin	
Vela, *Sails*.. ....Vel	Velr	
Virgo, *Virgin*.........Vir	Virg	
Volans, *Flying Fish*.....Vol	Voln	
Vulpecula, *Fox*.........Vul	Vulp	

The 4-letter abbreviations are intended to be used in cases where a maximum saving of space is not necessary.

EXTRA-GALACTIC NEBULAE

Among the hundreds of thousands of systems far beyond our own galaxy relatively few are readily seen in small telescopes. The following list contains a selection of the closer brighter objects of this kind. The first five columns give the catalogue numbers, constellation and position on the celestial sphere. In the column *Cl*, *E* indicates an elliptical nebula, *I* an irregular object, and *Sa*, *Sb*, *Sc* spiral nebulae, in which the spiral arms become increasingly dominant compared with the nucleus as we pass from *a* to *c*. The remaining columns give the apparent magnitude of the nebula, its distance in light years and the radial velocity in kilometers per second. As these objects have been selected on the basis of ease of observation, the faint, very distant objects which have spectacularly large red shifts, corresponding to large velocities of recession, are not included.

N.G.C.	M	Con	α 1950 δ h m	° ′	Cl	Dimens. ′ ′	Mag.	Distance l.y.	Vel. km/sec
221	32	And	00 39.9	+40 36	E	3×3	8.8	800,000	− 185
224	31	And	00 40.0	+41 00	Sb	160×40	5.0	800,000	− 220
SMC		Tuc	00 53	−72 38	I	220×220	1.5	100,000	+ 170
598	33	Tri	01 31.0	+30 24	Sc	60×40	7.0	700,000	− 70
LMC		Dor	05 21	−69 27	I	430×530	0.5	90,000	+ 280
3031	81	UMa	09 51.5	+69 18	Sb	16×10	8.3	2,400,000	− 30
3034	82	UMa	09 51.8	+69 58	I	7× 2	9.0	2,600,000	+ 290
3368	96	Leo	10 44.1	+12 05	Sa	7× 4	10.0	5,700,000	+ 940
3623	65	Leo	11 16.3	+13 22	Sb	8× 2	9.9	5,000,000	+ 800
3627	66	Leo	11 17.6	+13 16	Sb	8× 2	9.1	4,300,000	+ 650
4258		CVn	12 16.5	+47 34	Sb	20× 6	8.7	4,600,000	+ 500
4374	84	Vir	12 22.5	+13 09	E	3× 2	9.9	6,000,000	+1050
4382	85	Com	12 22.9	+18 28	E	4× 2	10.0	3,700,000	+ 500
4472	49	Vir	12 27.2	+08 16	E	5× 4	10.1	5,700,000	+ 850
4565		Com	12 33.9	+26 16	Sb	15× 1	11.0	7,600,000	+1100
4594		Vir	12 37.4	−11 20	Sa	7× 2	9.2	7,200,000	+1140
4649	60	Vir	12 41.1	+11 50	E	4× 3	9.5	7,500,000	+1090
4736	94	CVn	12 48.6	+41 24	Sb	5× 4	8.4	3,000,000	+ 290
4826	64	Com	12 54.3	+21 57	Sb	8× 4	9.2	1,300,000	+ 150
5005		CVn	13 08.6	+37 20	Sc	5× 2	11.1	6,600,000	+ 900
5055	63	CVn	13 13.6	+42 18	Sb	8× 3	9.6	3,600,000	+ 450
5194	51	CVn	13 27.8	+47 27	Sc	12× 6	7.4	3,000,000	+ 250
5236	83	Hya	13 34.2	−29 36	Sc	10× 8	8	2,900,000	+ 500
6822		Sgr	19 42.4	−14 53	I	20×10	11	1,000,000	− 150
7331		Peg	22 34.8	+33 59	Sb	9× 2	10.4	5,200,000	+ 500

GALACTIC NEBULAE

The galactic nebulae here listed have been selected to include the most readily observable representatives of planetary nebulae such as the Ring Nebula in Lyra, diffuse bright nebulae like the Orion nebula and dark absorbing nebulosities such as the Coal Sack. These objects are all located in our own galactic system. The first five columns give the identification and position as in the table of clusters. In the *Cl* column is given the classification of the nebula, planetary nebulae being listed as *Pl*, diffuse nebulae as *Dif*, and dark nebulae as *Drk*. *Size* indicates approximately the greatest apparent diameter in minutes of arc; and *m n* is the magnitude of the planetary nebula and *m ** is the magnitude of its central star. The distance is given in light years, and the name of the nebulae is added for the better known objects.

N.G.C.	M	Con	α 1950 δ h m ° ′		Cl	Size ′	m′ n	m *	Dist. l.y.	Name
650	76	Per	01 38.3	+51 20	Pl	1.5	11	17	15,000	·
1952	1	Tau	05 31.5	+21 59	Pl	6	11	16	10,000	Crab
1976	42	Ori	05 32.5	−05 25	Dif	30			1,800	Orion
B33		Ori	05 28.0	−02 29	Drk	4			300	Horsehead
2261		Mon	06 36.4	+08 47	Dif	2				Hubble's var
2392		Gem	07 26.2	+21 02	Pl	0.3	8	10	2,800	
2440		Pup	07 39.6	−18 05	Pl	0.9	11	16	8,600	
3587	97	UMa	11 11.8	+55 17	Pl	3.3	11	14	12,000	Owl
		Cru	12 48	−63	Drk	300			300	Coalsack
6210		Her	16 42.4	+23 54	Pl	0.3	10	12	5,600	
B72		Oph	17 20.5	−23 36	Drk	20			400	S nebula
6514	20	Sgr	17 59.5	−23 02	Dif	24			3,200	Trifid
B86		Sgr	17 59.9	−27 52	Drk	5				
6523	8	Sgr	18 00.6	−24 23	Dif	50			3,600	Lagoon
6543		Dra	17 58.6	+66 38	Pl	0.4	9	11	3,500	
6572		Oph	18 10.2	+06 50	Pl	0.2	9	12	4,000	
B92		Sgr	18 12.7	−18 15	Drk	15				
6618	17	Sgr	18 18.0	−16 12	Dif	26			3,000	Horseshoe
6720	57	Lyr	18 52.0	+32 58	Pl	1.4	9	14	5,400	Ring
6826		Cyg	19 43.5	+50 24	Pl	0.4	9	11	3,400	
6853	27	Vul	19 57.4	+22 35	Pl	8	8	13	3,400	Dumb-bell
6960		Cyg	20 43.6	+30 32	Dif	60				Network
7000		Cyg	20 57.0	+44 07	Dif	100				N. America
7009		Aqr	21 01.4	−11 34	Pl	0.5	8	12	3,000	
7662		And	23 23.4	+42 12	Pl	0.3	9	13	3,900	

73

STAR CLUSTERS

The star clusters for this observing list have been selected to include the more conspicuous members of the two main classes—open clusters and globular clusters. Most of the data are from Shapley's *Star Clusters* and from Trumpler's catalogue in Lick Bulletin No. 420. In the following table *N.G.C.* indicates the serial number of the cluster in the New General Catalogue of Clusters and Nebulae; *M*, its number in Messier's catalogue; *Con.*, the constellation in which it is located; α and δ, its right ascension and declination; *Cl.*, the kind of cluster, *Op* for open or galactic and *Gl* for globular; *Diam.*, the apparent diameter in minutes of arc; *Mag. B.S.*, the magnitude of the fifth brightest star in the case of open clusters, the mean of the 25 brightest for globulars; *No.*, the number of stars in the open clusters down to the limiting magnitudes of the photographs on which the particular clusters were studied; *Int. mag.*, the total apparent magnitude of the globular clusters; and *Dist*, the distance in light years.

N.G.C.	M	Con.	α 1950 h m	δ ° '	Cl.	Diam. '	Mag. B.S.	No.	Int. mag.	Dist. l.y
869		h Per	02 15.5	+56 55	Op	30	7			4,300
884		χPer	02 18.9	+56 53	Op	30	7			4,300
1039	34	Per	02 38.3	+42 35	Op	30	9	80		1,500
Pleiades	45	Tau	03 44.5	+23 58	Op	120	4.2	250		490
Hyades		Tau	04 17	+15 30	Op	400	4.0	100		120
1912	38	Aur	05 25.3	+35 48	Op	18	9.7	100		2,800
2099	37	Aur	05 49.0	+32 33	Op	24	9.7	150		2,700
2168	35	Gem	06 05.7	+24 21	Op	29	9.0	120		2,700
2287	41	C Ma	06 44.9	−20 42	Op	32	9	50		1,300
2632	44	Cnc	08 37.2	+20 10	Op	90	6.5	350		490
5139		ωCen	13 23.7	−47 03	Gl	23	12.9		3	22,000
5272	3	C Vn	13 39.9	+28 38	Gl	10	14.2		4.5	40,000
5904	5	Ser	15 15.9	+02 16	Gl	13	14.0		3.6	35,000
6121	4	Scr	16 20.5	−26 24	Gl	14	13.9		5.2	24,000
6205	13	Her	16 39.9	+36 33	Gl	10	13.8		4.0	34,000
6218	12	Oph	16 44.6	−01 51	Gl	9	14.0		6.0	36,000
6254	10	Oph	16 54.5	−04 02	Gl	8	14.1		5.4	36,000
6341	92	Her	17 15.6	+43 12	Gl	8	13.9		5.1	36,000
6494	23	Sgr	17 54.0	−19 01	Op	27	10.2	120		2,200
6611	16	Ser	18 16.0	−13 48	Op	8	10.6	55		6,700
6656	22	Sgr	18 33.3	−23 57	Gl	17	12.9		3.6	22,000
7078	15	Peg	21 27.6	+11 57	Gl	7	14.3		5 2	43,000
7089	2	Aqr	21 30.9	−01 04	Gl	8	14.6		5.0	45,000
7092	39	Cyg	21 30.5	+48 13	Op	32	6.5	25		1,000
7654	52	Cas	23 22.0	+61 19	Op	13	11.0	120		4,400

Star	R.A. 1950	Decl. 1950	Mag.	Type	Ann. Proper Motion	Parallax	Distance in Light Years	Abs. Mag.	Rad. Vel.
	h m	° ′			″	″			km./sec.
φ Sgtr........	18 43	−27 03	3.3	B8	.150	.015	217	−0.8	+21.5*
‖β Lyra........	48	+33 18	3.4–4.1	B2p	.011	.006	543	−2.7	−19.0*
σ Sgtr........	52	−26 22	2.1	B3	.067	.021	155	−1.3	−10.7
γ Lyra........	57	+32 37	3.3	B9p	.008	.016	204	−0.7	−21.5*
‖ζ Sgtr........	59	−29 57	2.7	A2	.019	.035	93	0.4	+22.1
ζ Aqil........	19 03	+13 47	3.0	A0	.103	.038	86	0.9	−25. *
τ Sgtr........	04	−27 45	3.4	K0	.268	.036	91	1.2	+45.4*
π Sgtr........	07	−21 06	3.0	F2	.041	.017	192	−0.8	− 9.8
δ Drac........	13	+67 34	3.2	G8	.135	.028	116	0.4	+24.8
δ Aqil........	23	+ 3 01	3.4	A3	.267	.052	63	2.0	−32.3*
‖β¹ Cygn......	29	+27 51	3.2	K0	.010	.010	326	−1.8	−23.9*
‖δ Cygn......	43	+45 00	3.0	A1	.067	.023	116	0.2	−20.
γ Aqil........	44	+10 29	2.8	K3	.018	.018	181	−0.9	− 2.0
α Aqil........	48	+ 8 44	0.9	A2	.659	.184	18	2.2	−26.1
θ Aqil........	20 09	− 0 58	3.4	A0	.035	.018	181	−0.3	−28.6*
‖β Capr........	18	−14 56	3.2	F8	.042	.022	148	−0.1	−19.0*
γ Cygn.......	20	+40 06	2.3	F8	.006	.008	407	−3.2	− 7.6
α Pavo.......	22	−56 54	2.1	B3	.087	.014	233	−2.2	+ 1.8*
α Indi........	34	−47 28	3.2	G2	.072	.034	96	0.9	− 1.1
α Cygn.......	40	+45 06	1.3	A2p	.004	.002	1630	−7.2	− 6.3*
ε Cygn.......	44	+33 47	2.6	G7	.485	.040	81	0.6	−10.5*
ζ Cygn.......	21 11	+30 01	3.4	G6	.061	.018	181	−0.3	+16.9*
α Ceph.......	17	+62 22	2.6	A2	.163	.076	43	2.0	− 8.
β Ceph.......	28	+70 20	3.3–3.4	B1	.013	.006	543	−2.8	− 7.2
β Aqar........	29	− 5 48	3.1	G1	.020	.008	407	−2.4	+ 6.7
ε Pegs........	42	+ 9 39	2.5	K2	.028	.014	233	−1.8	+ 5.2
δ Capr........	44	−16 21	3.0	A3	.395	.062	53	2.0	− 6.4*
γ Grus........	51	−37 36	3.2	B8	.114	.020	163	−0.3	− 2.1
α Aqar........	22 03	− 0 34	3.2	G0	.019	.006	543	−2.9	+ 7.6
α Grus........	05	−47 12	2.2	B5	.202	.036	91	0.0	+11.8
α Tucn.......	15	−60 31	2.9	K5	.088	.019	172	−0.7	+42.2*
β Grus........	40	−47 09	2.2	M6	.131	.010	326	−2.8	+ 1.6
η Pegs........	41	+29 58	3.1	G1	.039	.016	204	−0.9	+ 4.4*
α Psc. A......	55	−29 53	1.3	A3	.367	.118	28	1.7	+ 6.5
β Pegs........	23 01	+27 49	2.6	M3	.235	.020	163	−0.9	+ 8.6
α Pegs........	02	+14 56	2.6	A0	.077	.033	99	0.2	− 4. *
γ Ceph.......	37	+77 21	3.4	K1	.167	.062	53	2.4	−42.0