Knowle Astronomical Society Almanac 2007

Knowle Astronomical Society is pleased to present its annual review of significant astronomical events for the year ahead. We hope that beginners and experts alike will find it informative and useful. Every effort has been made to ensure accurate timings for these events from the vicinity of Knowle and Dorridge. It is recommended however that observers check exact local timings a few days beforehand (as well as the weather forecast!). This year's edition also includes new appendices giving details of the Messier objects and some notable double stars. Please note that when observing before sunset or after sunrise every precaution should be taken to avoid looking directly at the Sun using any form of optical instrument, including cameras and even the unaided human eye.

British Summer Time

All times in this almanac are quoted in Greenwich Mean Time (GMT). British Summer Time (BST) will be in force between March 25th and October 28th. To convert from GMT to BST add one hour to the quoted times.

Sun and Moon

	Sunrise	Sunset	Phases of the Moon			
	15th of month		First Quarter	Full Moon	Last Quarter	New Moon
January	8:05	16:22	25th	3rd	11th	19th
February	7:20	17:17	24th	2nd	10th	17th
March	6:19	18:08	25th	3rd	12th	19th
April	5:08	19:01	24th	2nd	10th	17th
May	4:11	19:51	23rd	2nd	10th	16th
June	3:43	20:26	22nd	1st, 30th	8th	15th
July	4:01	20:18	22nd	30th	7th	14th
August	4:47	19:29	20th	28th	5th	12th
September	5:38	18:20	19th	26th	4th	11th
October	6:28	17:11	19th	26th	3rd	11th
November	7:23	16:13	17th	24th	1st	9th
December	8:05	15:52	17th	24th	1st, 31st	9th

Equinoxes and Solstices

Vernal Equinox	March 21st	Summer Solstice	June 21st
Autumnal Equinox	September 23rd	Winter Solstice	December 22nd

Eclipses

A *Total Lunar Eclipse* takes place on March 3rd between 21:31 and 1:12 the following morning. This is the only eclipse visible from the British Isles during 2007.

On March 19th a *Partial Solar Eclipse* is visible from much of Asia and Alaska.

A *Total Lunar Eclipse* on August 28th is visible from most of the Americas, the Pacific and eastern parts of Asia.

On September 11th a *Partial Solar Eclipse* will be visible from parts of South America and Antarctica.

The Planets

The best opportunities to see *Mercury* in 2006 occur in the evening sky for a couple of weeks around greatest elongation east on February 7th and in the morning sky for a couple of weeks around greatest elongation west on November 8th. It may also be possible to find Mercury with binoculars close to a very young waxing crescent Moon low down on the horizon just after sunset on May 17th.

Having returned to the evening sky at the end of 2006 *Venus* will be a brilliant and conspicuous object for several hours after sunset during the first half of 2007. Reaching Greatest Elongation East on June 9th it is then gradually lost into twilight over the next couple of months until emerging into the morning sky during August. It will then proceed to put on an equally impressive pre-dawn display during the final months of the year.

Mars is too close to the Sun to be properly observed during the first few months of 2007. From May onwards however it steadily gains altitude in the morning sky and by August it will be rising before midnight. Mars reaches opposition in Gemini on December 24th. This is quite a distant opposition and the angular size of the planet is only 16" compared with 25" for the very close 2003 opposition.

Jupiter starts the year as a morning planet but by the end of April is rising before midnight and reaches opposition in Ophiuchus on June 5th. It then remains an evening object until lost in twilight during November. This year's apparition is not particularly favourable from our latitude as the planet is never more than 16^{O} above the horizon. The occultations, transits and shadow transits of Jupiter's Galilean satellites are easy to observe in small telescopes. It is very common to see one or even two transits or shadow transits in progress, but triple and other multiple events are much rarer. This is especially the case at the moment because (owing to the current orientation of the orbital plane of the satellites relative to Earth) Callisto, the outermost of the four, is not participating in any of these events again until 2008. The only multiple events observable from the British Isles during 2007 are:-

October 30th 18:01 – 18:07 Io transit & shadow transit, Ganymede shadow transit.
November 15th16:55 – 17:43 Io transit & shadow transit, Europa transit & shadow transit

Both of these events (particularly the latter) will be tough to observe owing to the low altitude of the planet.

Saturn is a conspicuous evening object at the start of 2007 and reaches opposition on February 10th in Leo. The northern polar regions of the planet are now no longer obscured by the planet's rings which will continue to close until we see them edge on during 2009. Saturn remains an evening planet until lost in twilight during July. It then emerges into the morning sky during September and will rise before midnight again by the end of November.

Uranus which, at magnitude 5.7, is only just visible to the naked eye under good conditions is at opposition in Aquarius on September 9th and *Neptune* which, at magnitude 7.8, requires at least good binoculars to see, is at opposition in Capricornus on August 13th.

Conjunctions and Occultations

The Moon encounters each planet during its monthly journey through the Zodiac. These conjunctions are often attractive sights, particularly those that occur at dawn or dusk when the Moon displays its crescent phase. Conjunctions between the planets are also reasonably frequent events. Sometimes the Moon will even pass directly in front of (i.e. occult) a planet or first magnitude star. Lunar occultations of fainter naked eye stars are fairly regular events. The following is a synopsis of the most notable conjunctions and occultations during 2007.

Venus has a series of encounters with the waxing crescent Moon in the evening sky during the first half of the year, the closest of which are the January 20th and February 19th events when the separation is less than 1½^{O}. Of these two, the February conjunction will be easier to observe since the Moon will be two days old compared with just one day old for the January event. By June Venus is joined by Saturn in evening twilight and on the 18th and 19th of June the two planets are close to a thick (3 – 4 day old) crescent Moon. Venus is actually occulted by the Moon during daylight on June 18th. This event takes place between 14:01 and 15:21 and should be observable with binoculars. After this date the separation between Venus and Saturn continues to close until they are less than a degree apart on the evening of July 1st. The two remain close together as they move into the morning sky and there is another attractive conjunction on the morning of October 7th when the waning crescent Moon will be between them.

Mars has a very close conjunction with the Full Moon, as it comes to opposition on the night of 23rd and 24th December. By 03:53 on the 24th the separation is only 2'.

Saturn also has a series of very close encounters with the Moon during 2007. The two are less than 2^{O} apart as they rise on January 6th and then pass within just 11' of each other on February 2nd when the Moon will be full. A month later on the evening of March 1st they are close again and between 2.44 and 2.50 the following morning there will actually be a 'grazing' occultation. During this very interesting event the planet will be only partly obscured for a few minutes by the Moon's limb. The next encounter is closer still and at just after 5am on the morning of March 29th we will be able to see the start of a full occultation, low in the western sky before the Moon sets. On the following morning (between 03:30 and 4:19 on March 30th) there is an occultation of Regulus, the brightest star of Leo. Regulus is again occulted on July 17th but this time the event will be in broad daylight with the crescent Moon at fairly low altitude and difficult to observe. April's encounter between the Moon and Saturn will not be particularly close as observed from the British Isles, but on 22nd May we will be able to see a complete occultation between 19:10 and 20:17. This event will start in daylight and Saturn will re-emerge from behind the Moon just after sunset. It should however be readily observable in telescopes or even binoculars.

Uranus is occulted on the evening of 18th February but this event will be at low altitude and therefore difficult to observe.

The Moon had several skirmishes with the Pleiades in 2006 and there are more to come in 2007. Maia (magnitude 3.9), Taygeta (4.3) and Caelano (5.4) are occulted on the evening of February 23rd. These three plus Electra (magnitude 3.7) are occulted in the very early hours of August 7th. The same thing happens again on the night of October 27th. The final event, on the evening of December 21st is a repeat of the first, with the Moon missing Electra but occulting the other three.

Minor Planets

Many dozens of minor planets (asteroids) are within range of amateur instruments. Amongst the first ten to be discovered the following come to opposition during 2007:-

April	3 Juno	October	10 Hygiea
June	4 Vesta, 9 Metis	November	1 Ceres, 9 Flora
August	2 Pallas		

Meteor Showers

The following table shows the most important annual meteor showers with the dates of their expected duration during 2007, the date of maximum intensity, estimated zenithal hourly rate (ZHR) at maximum and the phase of the Moon at maximum. Those showers with the highest percentage for the lunar phase will experience the most interference from moonlight, consequently reducing the numbers of meteors observed.

Shower	Duration	Maximum	ZHR	Lunar Phase at Max
Quadrantids	Jan 1st – Jan 5th	Jan 4th	120	99%
Lyrids	Apr 16th – Apr 25th	Apr 22nd	18	32%
Eta Aquarids	Apr 19th – May 28th	May 6th	60	85%
Southern Delta Aquarids	Jul 12th – Aug 19th	Jul 28th	20	97%
Perseids	Jul 17th – Aug 24th	Aug 13th	100	0%
Orionids	Oct 2nd – Nov 7th	Oct 21st	23	72%
Leonids	Nov 10th – Nov 23rd	Nov 18th	15	56%
Geminids	Dec 7th – Dec 17th	Dec 14th	120	21%

The Perseids in August are likely to be the best observed shower this year with virtually no interference from the Moon around the time of maximum.

Sources

The following are gratefully acknowledged:-

Burnham's Celestial Handbook, Castle Point Astronomy Club, Graystel Astronomy Software, HM Nautical Almanac Office, International Meteor Organization, National Maritime Museum / Royal Observatory Greenwich, Washington Visual Double Star Catalog, Whitaker's Almanack.

Appendices

Appendix 1: Summary of Key Events in 2007
Appendix 2: The Messier Catalogue
Appendix 3: 100 Notable Double & Multiple Stars

Note: appendices 2 & 3 are included with the internet version only. If you would like a hard copy please contact Nigel Foster.

Appendix 1: Summary of Key Events in 2007

Jan 6th	Saturn < 2° from Moon (PM)
Jan 20th	Venus < 1.5° from Moon (PM)
Feb 2nd	Saturn 11' from Moon (PM)
Feb 7th	Mercury at Greatest Elongation East
Feb 10th	Saturn at Opposition
Feb 19th	Venus < 1.5° from Moon (PM)
Mar 2nd	Partial ("grazing") occultation of Saturn by Moon (2:44 – 2:50 AM)
Mar 3rd	Total Lunar Eclipse (21:31 PM – 1:12 AM the following morning)
Mar 29th	Saturn occulted by Moon (AM – Moon sets from UK before event ends)
Mar 30th	Regulus occulted by Moon (3:30 – 4:19 AM)
May 22nd	Saturn occulted by Moon (19:10 – 20:17 PM)
Jun 5th	Jupiter at Opposition
Jun 9th	Venus at Greatest Elongation East
Jun 18th	Venus occulted by Moon (14:01 – 15:21 PM)
Jun 18th/19th	Moon, Venus and Saturn in Conjunction (PM)
Jul 1st	Saturn < 1° from Venus (PM)
Aug 13th	Perseids at maximum
Oct 17th	Moon, Venus and Saturn in Conjunction (AM)
Nov 8th	Mercury at Greatest Elongation West
Dec 24th	Mars 2' from Moon (3:53 AM)
Dec 24th	Mars at Opposition

Appendix 2: The Messier Catalogue

	Popular Name	Constellation	Type	R. A.		Declination		Mag
				Hrs	Mins	Degs	Mins	
M 1	Crab nebula	Taurus	Supernova Remnant	5	35	22	1	8.4
M 2		Aquarius	Globular Cluster	21	34	0	49	6.5
M 3		Canes Venatici	Globular Cluster	13	42	28	23	6.4
M 4		Scorpius	Globular Cluster	16	24	-26	32	5.9
M 5		Serpens	Globular Cluster	15	19	2	5	5.8
M 6	Butterfly cluster	Scorpius	Open Cluster	17	40	-32	13	4.2
M 7		Scorpius	Open Cluster	17	54	-34	49	3.3
M 8	Lagoon nebula	Sagittarius	Nebula	18	4	-24	23	5.8
M 9		Ophiuchus	Globular Cluster	17	19	-18	31	7.9
M 10		Ophiuchus	Globular Cluster	16	57	-4	6	6.6
M 11	Wild Duck cluster	Scutum	Open Cluster	18	51	-6	16	5.8
M 12		Ophiuchus	Globular Cluster	16	47	-1	57	6.6
M 13	Great Cluster in Hercules	Hercules	Globular Cluster	16	42	36	28	5.9
M 14		Ophiuchus	Globular Cluster	17	38	-3	15	7.6
M 15		Pegasus	Globular Cluster	21	30	12	10	6.4
M 16	Eagle nebula	Serpens	Cluster + Nebula	18	19	-13	47	6.0
M 17	Omega nebula	Sagittarius	Cluster + Nebula	18	21	-16	11	6.0
M 18		Sagittarius	Open Cluster	18	20	-17	8	6.9
M 19		Ophiuchus	Globular Cluster	17	3	-26	16	7.2
M 20	Trifid nebula	Sagittarius	Cluster + Nebula	18	2	-23	2	6.3
M 21		Sagittarius	Open Cluster	18	5	-22	30	5.9
M 22		Sagittarius	Globular Cluster	18	36	-23	54	5.1
M 23		Sagittarius	Open Cluster	17	57	-19	1	5.5
M 24	Small Sagittarius Star Cloud	Sagittarius	Open Cluster	18	18	-18	25	N/A
M 25		Sagittarius	Open Cluster	18	32	-19	15	4.6
M 26		Scutum	Open Cluster	18	45	-9	24	8.0
M 27	Dumbbell nebula	Vulpecula	Planetary Nebula	19	60	22	43	8.1
M 28		Sagittarius	Globular Cluster	18	25	-24	52	6.9
M 29		Cygnus	Open Cluster	20	24	38	32	6.6
M 30		Capricornus	Globular Cluster	21	40	-23	11	7.5
M 31	Great Nebula in Andromeda	Andromeda	Galaxy	0	43	41	16	3.5
M 32		Andromeda	Galaxy	0	43	40	52	8.2
M 33	Triangulum galaxy	Triangulum	Galaxy	1	34	30	39	5.7
M 34		Perseus	Open Cluster	2	42	42	47	5.2
M 35		Gemini	Open Cluster	6	9	24	20	5.1
M 36		Auriga	Open Cluster	5	36	34	8	6.0
M 37		Auriga	Open Cluster	5	52	32	33	5.6
M 38		Auriga	Open Cluster	5	29	35	50	6.4
M 39		Cygnus	Open Cluster	21	32	48	26	4.6
M 40	*spurious observation of double star in Ursa Major*							
M 41		Canis Major	Open Cluster	6	47	-20	44	4.5
M 42	Great Nebula in Orion	Orion	Nebula	5	35	-5	27	4.0
M 43		Orion	Nebula	5	36	-5	16	9.0
M 44	Beehive cluster / Praesepe	Cancer	Open Cluster	8	40	19	59	3.1
M 45	Pleiades / Seven Sisters	Taurus	Open Cluster	3	47	24	7	1.2
M 46		Puppis	Open Cluster	7	42	-14	49	6.1
M 47		Puppis	Open Cluster	7	37	-14	30	4.4
M 48		Hydra	Open Cluster	8	14	-5	48	5.8
M 49		Virgo	Galaxy	12	30	8	0	8.4
M 50		Monoceros	Open Cluster	7	3	-8	20	5.9
M 51	Whirlpool galaxy	Canes Venatici	Galaxy	13	30	47	12	8.4
M 52		Cassiopeia	Open Cluster	23	24	61	35	6.9
M 53		Coma Berenices	Globular Cluster	13	13	18	10	7.7
M 54		Sagittarius	Globular Cluster	18	55	-30	29	7.7

	Popular Name	Constellation	Type	R. A.		Declination		Mag
				Hrs	Mins	Degs	Mins	
M 55		Sagittarius	Globular Cluster	19	40	-30	58	7.0
M 56		Lyra	Globular Cluster	19	17	30	11	8.3
M 57	Ring nebula in Lyra	Lyra	Planetary Nebula	18	54	33	2	9.0
M 58		Virgo	Galaxy	12	38	11	49	9.8
M 59		Virgo	Galaxy	12	42	11	39	9.8
M 60		Virgo	Galaxy	12	44	11	33	8.8
M 61		Virgo	Galaxy	12	22	4	28	9.7
M 62		Ophiuchus	Globular Cluster	17	1	-30	7	6.6
M 63	Sunflower galaxy	Canes Venatici	Galaxy	13	16	42	2	8.6
M 64	Black-eye galaxy	Coma Berenices	Galaxy	12	57	21	41	8.5
M 65		Leo	Galaxy	11	19	13	5	9.3
M 66		Leo	Galaxy	11	20	12	59	9.0
M 67		Cancer	Open Cluster	8	50	11	49	6.9
M 68		Hydra	Globular Cluster	12	40	-26	45	8.2
M 69		Sagittarius	Globular Cluster	18	31	-32	21	7.7
M 70		Sagittarius	Globular Cluster	18	43	-32	18	8.1
M 71		Sagitta	Globular Cluster	19	54	18	47	8.3
M 72		Aquarius	Globular Cluster	20	54	-12	32	9.4
M 73		Aquarius	Open Cluster	20	59	-12	38	9.0
M 74		Pisces	Galaxy	1	37	15	47	9.2
M 75		Sagittarius	Globular Cluster	20	6	-21	55	8.6
M 76	Little Dumbbell	Perseus	Planetary Nebula	1	42	51	34	12.0
M 77		Cetus	Galaxy	2	43	0	1	8.8
M 78		Orion	Nebula	5	47	0	3	8.0
M 79		Lepus	Globular Cluster	5	25	-24	33	8.0
M 80		Scorpius	Globular Cluster	16	17	-22	59	7.2
M 81	Bode's nebulae (with M82)	Ursa Major	Galaxy	9	56	69	4	6.9
M 82	Bode's nebulae (with M81)	Ursa Major	Galaxy	9	56	69	41	8.4
M 83		Hydra	Galaxy	13	37	-29	52	7.6
M 84		Virgo	Galaxy	12	25	12	53	9.3
M 85		Coma Berenices	Galaxy	12	25	18	11	9.2
M 86		Virgo	Galaxy	12	26	12	57	9.2
M 87		Virgo	Galaxy	12	31	12	24	8.6
M 88		Coma Berenices	Galaxy	12	32	14	25	9.5
M 89		Virgo	Galaxy	12	36	12	33	9.8
M 90		Virgo	Galaxy	12	37	13	10	9.5
M 91		Coma Berenices	Galaxy	12	35	14	30	10.2
M 92		Hercules	Globular Cluster	17	17	43	8	6.5
M 93		Puppis	Open Cluster	7	45	-23	52	6.2
M 94		Canes Venatici	Galaxy	12	51	41	7	8.2
M 95		Leo	Galaxy	10	44	11	42	9.7
M 96		Leo	Galaxy	10	47	11	49	9.2
M 97	Owl nebula	Ursa Major	Planetary Nebula	11	15	55	1	11.2
M 98		Coma Berenices	Galaxy	12	14	14	54	10.1
M 99	Pin-wheel nebula	Coma Berenices	Galaxy	12	19	14	25	9.8
M 100		Coma Berenices	Galaxy	12	23	15	49	9.4
M 101		Ursa Major	Galaxy	14	3	54	21	7.7
M 102	*probable duplicate observation of M 101*							
M 103		Cassiopeia	Open Cluster	1	33	60	42	7.4
M 104	Sombrero galaxy	Virgo	Galaxy	12	40	-11	37	8.3
M 105		Leo	Galaxy	10	48	12	35	9.3
M 106		Canes Venatici	Galaxy	12	19	47	18	8.3
M 107		Ophiuchus	Globular Cluster	16	33	-13	3	8.1
M 108		Ursa Major	Galaxy	11	12	55	40	10.1
M 109		Ursa Major	Galaxy	11	58	53	23	9.8
M 110		Andromeda	Galaxy	0	40	41	41	8.0

Appendix 3: 100 Notable Double & Multiple Stars

		Proper Name/ Comments		Distance Arcsecs	PA Degs	Year	Magnitudes		R. A. Hrs	R. A. Mins	Declination Degs	Declination Mins
1	π And			36.1	174	1937	4.4	8.9	0	37	+ 33	43
2	α Cas	Schedar		64.4	280	1913	2.5	8.5	0	41	+ 56	32
3	η Cas	Achird	AB	12.2	315	1993	3.4	7.5	0	49	+ 57	49
			BC	10.8	2	1928	7.2	8.6				
4	ζ Psc			22.9	63	1986	5.2	6.3	1	14	+ 7	35
5	γ Ari	Mesarthim		7.5	0	1988	4.8	4.8	1	54	+ 19	18
6	λ Ari			38.5	47	1972	4.8	7.3	1	58	+ 23	36
7	α Psc			1.9	292	1966	4.3	5.2	2	2	+ 2	46
8	γ And	Almach		9.6	63	1987	2.3	4.8	2	4	+ 42	20
9	ι Tri			3.8	72	1961	5.2	6.6	2	12	+ 30	18
10	ι Cas		AB	2.2	241	1966	4.6	7.0	2	29	+ 67	24
			AC	7.3	114	1961	4.6	8.5				
11	α UMi	Polaris		18.4	218	1955	2.1	9.1	2	31	+ 89	15
12	γ Cet	Kaffaljidhma		2.9	297	1986	3.6	7.4	2	43	+ 3	14
13	α For			1.9	294	1963	3.9	7.0	3	12	- 28	59
14	19 Tau	Taygeta		69.0	330	NA	4.4	8.1	3	45	+ 24	27
15	η Tau	Alcyone		117.0	288	NA	3.0	8.1	3	47	+ 24	6
16	ζ Per			12.9	209	1957	2.9	9.5	3	54	+ 31	52
17	32 Eri			6.8	347	1822	4.8	6.1	3	54	- 2	57
18	ε Per			8.8	9	1938	3.0	8.2	3	58	+ 40	0
19	o^2 Eri		A-BC	83.4	104	1970	4.4	9.7	4	15	- 7	34
			BC	8.9	338	1994	9.7	11.1				
20	$\theta^{1/2}$ Tau			337.0	346	1917	3.4	3.9	4	29	+ 15	52
21	80 Tau			1.6	18	1967	5.7	8.0	4	30	+ 15	38
22	66 Eri			52.8	9	1922	5.3	8.5	5	7	- 4	39
23	β Ori	Rigel		9.4	202	1925	0.1	6.7	5	15	- 8	12
24	η Ori			1.5	77	1966	3.8	4.8	5	24	- 2	23
25	δ Ori	Mintaka		52.8	360	1932	2.5	6.6	5	32	- 0	17
26	λ Ori	Heka		4.4	44	1957	3.7	5.6	5	35	+ 9	56
27	θ^1 Ori	The Trapezium	AB	13.3	61	1925	5.4	6.3	5	35	- 5	23
			AC	13.1	311	1925	5.4	6.8				
			AD	16.8	342	1925	5.4	7.2				
28	θ^2 Ori			52.5	92	1937	5.2	6.5	5	35	- 5	25
29	ι Ori			11.4	141	1932	2.9	7.0	5	35	- 5	55
30	Σ 747			36.0	223	1924	4.7	5.6	5	35	- 6	1
31	Σ 761	Same field as σ Ori	AB	68.3	202	1931	7.7	7.9	5	39	- 2	34
			BC	8.5	268	1931	7.9	8.2				
32	σ Ori		AB	12.9	84	1934	3.8	6.6	5	39	- 2	36
			AD	11.2	236	1936	3.8	10.0				
			AC	42.0	61	1934	3.8	6.7				
33	ζ Ori	Alnitak		2.3	166	1990	2.0	4.2	5	41	- 1	57
34	γ Lep			94.9	351	1959	3.8	6.4	5	45	- 22	26
35	β Mon		AB	7.2	132	1831	4.7	5.2	6	29	- 7	2
			BC	2.9	107	1992	5.7	6.2				
36	ε Gem	Mebsuta		110.0	94	1925	3.2	9.2	6	44	+ 25	8
37	38 Gem			7.3	147	1990	4.7	7.7	6	55	+ 13	11
38	δ Gem	Wasat		6.3	218	1962	3.5	8.5	7	20	+ 21	59
39	α Gem	Castor	AB	3.3	73	1992	2.0	2.9	7	35	+ 31	53
			AC	71.2	164	1990	2.0	8.8				
40	ζ Cnc	Tegmeni	AB	0.9	337	1968	5.6	6.0	8	12	+ 17	39
			AB-C	5.7	82	1987	5.1	6.2				
41	ι Cnc			30.4	307	1828	4.0	6.6	8	47	+ 28	46
42	ε Hya		AB	3.1	271	1959	3.5	6.8	8	47	+ 6	25
			AC	19.3	195	1938	3.5	12.0				

		Proper Name/ Comments		Distance Arcsecs	PA Degs	Year	Magnitudes		R. A.		Declination	
									Hrs	Mins	Degs	Mins
43	ι UMa	Talitha		4.5	16	1958	3.9	9.5	8	59	+ 48	2
44	σ^2 UMa			2.4	20	1962	5.0	8.2	9	10	+ 67	7
45	φ UMa			0.4	48	1966	5.0	5.5	9	52	+ 54	4
46	α Leo	Regulus		177.0	307	1924	1.3	7.6	10	8	+ 11	57
47	γ Leo	Algieba		4.4	123	1966	2.6	3.8	10	20	+ 19	50
48	54 Leo			6.5	110	1958	4.5	6.3	10	56	+ 24	45
49	ξ UMa	Alula Australis		2.9	129	1968	4.3	4.8	11	18	+ 31	32
50	γ Crt			5.2	96	1955	4.1	9.6	11	25	- 17	41
51	δ Crv			24.2	214	1958	3.1	9.3	12	30	- 16	31
52	γ Vir	Porrima		4.7	306	1966	3.6	3.7	12	42	- 1	26
53	α CVn	Cor Caroli		19.3	228	1984	2.9	5.6	12	56	+ 38	19
54	ζ UMa	Mizar		14.4	151	1967	2.4	4.0	13	24	+ 54	55
55	ε Boo	Izar		2.6	343	1988	2.7	5.1	14	45	+ 27	4
56	ξ Boo			6.9	347	1962	4.7	6.8	14	51	+ 19	6
57	44 Boo			0.5	312	1968	5.3	6.2	15	4	+ 47	39
58	ι Lib			58.6	111	1943	4.7	9.4	15	12	- 19	47
59	δ Boo			105.0	79	1923	3.5	8.7	15	16	+ 33	18
60	μ Boo	Akalurops	A-BC	108.4	171	1834	4.3	6.5	15	24	+ 37	23
			BC	2.1	10	1994	7.2	7.8				
61	β Ser			30.8	265	1940	3.7	9.9	15	46	+ 15	25
62	ξ Sco		AB	0.9	358	1966	4.8	5.1	16	4	- 11	22
			AC	7.4	53	1959	4.9	7.2				
63	β Sco	Graffias		13.6	21	1980	2.6	4.9	16	5	- 19	48
64	ν Sco	Jabbah	AB	1.3	0	1991	4.4	6.9	16	12	- 19	28
			AC	41.2	337	1821	4.4	6.3				
			CD	2.3	53	1974	6.8	7.5				
65	σ CrB			6.2	229	1962	5.8	6.7	16	15	+ 33	52
66	σ Sco			20.0	273	1959	2.9	8.7	16	21	- 25	35
67	η Dra			5.3	143	1962	2.9	8.9	16	24	+ 61	30
68	α Sco	Antares		3.0	275	1959	1.2	5.4	16	29	- 26	26
69	16/17 Dra		AB	3.3	106	1983	5.6	6.6	16	36	+ 52	55
			AB-C	90.3	194	1833	5.1	5.5				
70	ζ Her			1.4	56	1961	2.8	5.5	16	41	+ 31	36
71	μ Dra			1.8	66	1966	5.8	5.8	17	5	+ 54	28
72	α Her	Ras Algethi		4.8	106	1993	3.5	5.4	17	15	+ 14	23
73	δ Her			8.8	241	1961	3.2	8.3	17	15	+ 24	50
74	ν Dra			61.9	312	1955	5.0	5.0	17	32	+ 55	10
75	ψ Dra	Dsiban		30.3	15	1832	4.6	5.8	17	42	+ 72	9
76	μ Her		A-BC	34.0	247	1955	3.4	9.8	17	46	+ 27	43
			BC	1.1	236	1964	10.3	10.8				
77	70 Oph			2.8	72	1967	4.2	5.9	18	6	+ 2	30
78	39 Dra			3.8	351	1975	5.1	7.6	18	24	+ 58	48
79	δ Scu			52.5	130	1912	4.7	9.2	18	42	- 9	3
80	ε^2 Lyr			2.3	86	1992	5.1	5.4	18	44	+ 39	37
81	ε^1 Lyr			2.5	353	1992	5.1	6.0	18	44	+ 39	40
82	$\theta^{1/2}$ Ser	Alya		22.3	104	1984	4.6	5.0	18	56	+ 4	12
83	β Cyg	Albireo		34.5	54	1822	3.1	5.1	19	31	+ 27	58
84	δ Cyg			2.2	247	1961	2.9	6.5	19	45	+ 45	8
85	o^1 Cyg			107.0	173	1836	3.8	7.0	20	14	+ 46	44
86	α^1 Cap	Al Giedi		6.6	172	1959	3.8	11.2	20	18	- 12	31
87	α^2 Cap			45.2	221	1912	4.2	9.6	20	18	- 12	33
88	β Cap	Dabih		205.3	267	1835	3.1	6.2	20	21	- 14	47
89	γ Del			9.6	267	1988	4.3	5.1	20	47	+ 16	7
90	ε Equ		AB	0.9	288	1961	5.8	6.3	20	59	+ 4	18
			AB-C	10.6	68	1991	5.4	7.4				
91	61 Cyg			30.4	149	1993	5.2	6.1	21	7	+ 38	45

		Proper Name/ Comments	Distance Arcsecs	PA Degs	Year	Magnitudes		R. A.		Declination	
								Hrs	Mins	Degs	Mins
92	τ Cyg		0.9	229	1961	3.8	6.4	21	15	+ 38	3
93	β Cep	Alfirk	13.4	249	1975	3.2	7.8	21	29	+ 70	34
94	μ Cyg		1.7	289	1967	4.7	6.1	21	44	+ 28	45
95	κ Peg		13.8	292	1958	4.5	10.0	21	45	+ 25	36
96	ξ Cep		7.6	278	1962	4.6	6.5	22	4	+ 64	38
97	ζ Aqr		2.0	198	1994	4.3	4.5	22	29	- 0	1
98	37 Peg		1.0	118	1969	5.5	7.0	22	30	+ 4	26
99	δ Cep		40.7	192	1961	4.5	7.5	22	29	+ 58	55
100	σ Cas		3.1	327	1983	5.0	7.1	23	59	+ 55	45

Note: for both appendices Right Ascension (R. A.) and Declination co-ordinates are J2000 epoch.