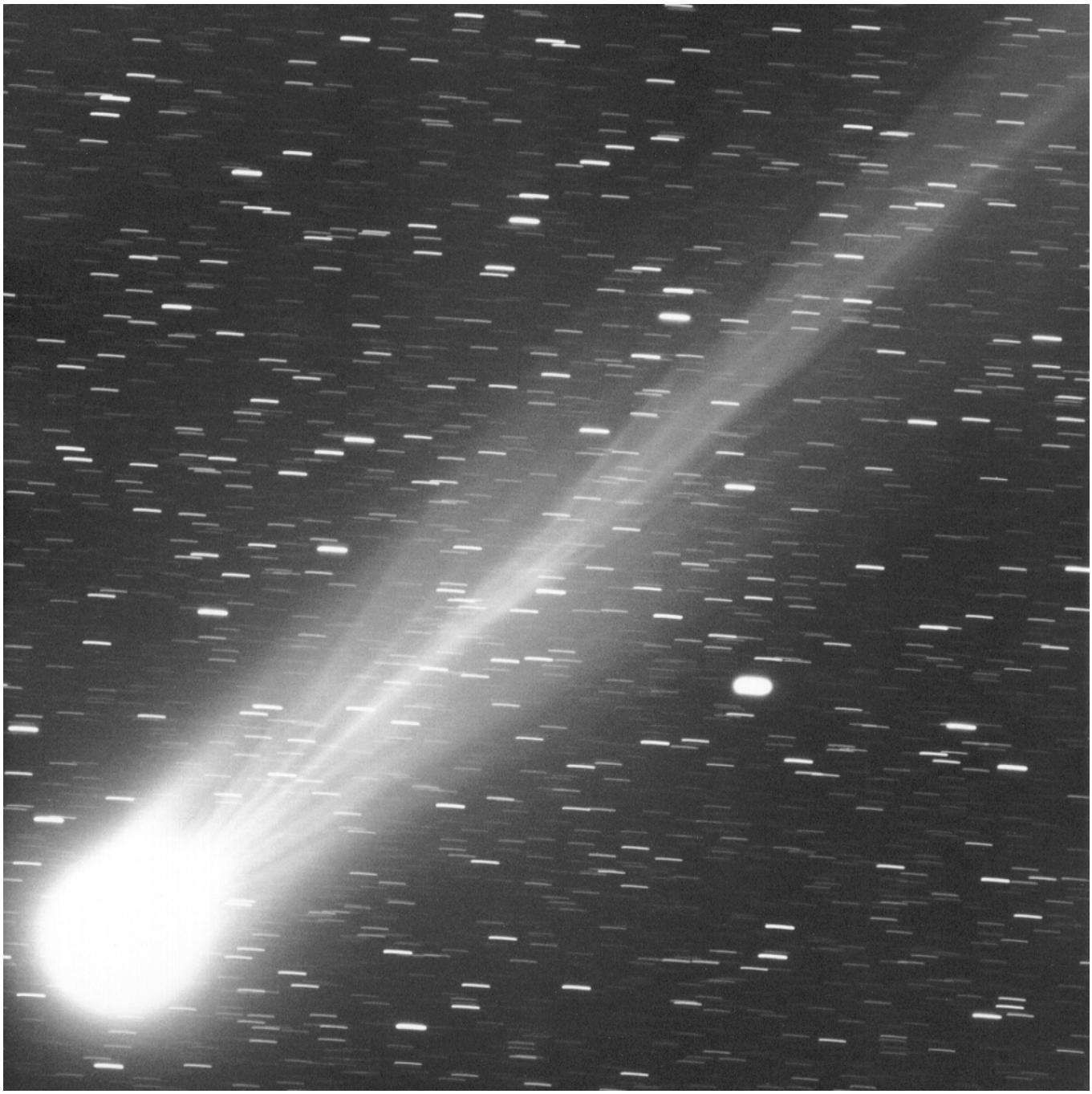
the ASTROGRAPH



Volume 35 No. 6 **June/July 2004**

the ASTROGRAPH

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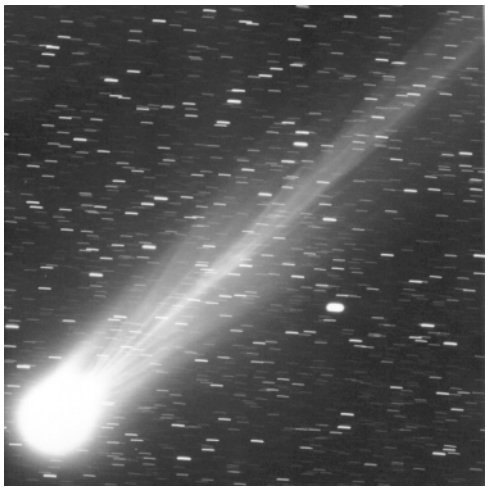

COVER PHOTOGRAPH

Object.....Comet Hyakutake
Photographer.....Chuck Vaughn
Instrument.....180mm F/2.8 camera lens
Film/Exposure.....Hypersensitized Kodak 2415 film/15 minutes
Date.....24 March 1996
Filter.....minus violet

VOLUME 35 No. 6

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Features

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Comets During the Spring of 2004

by

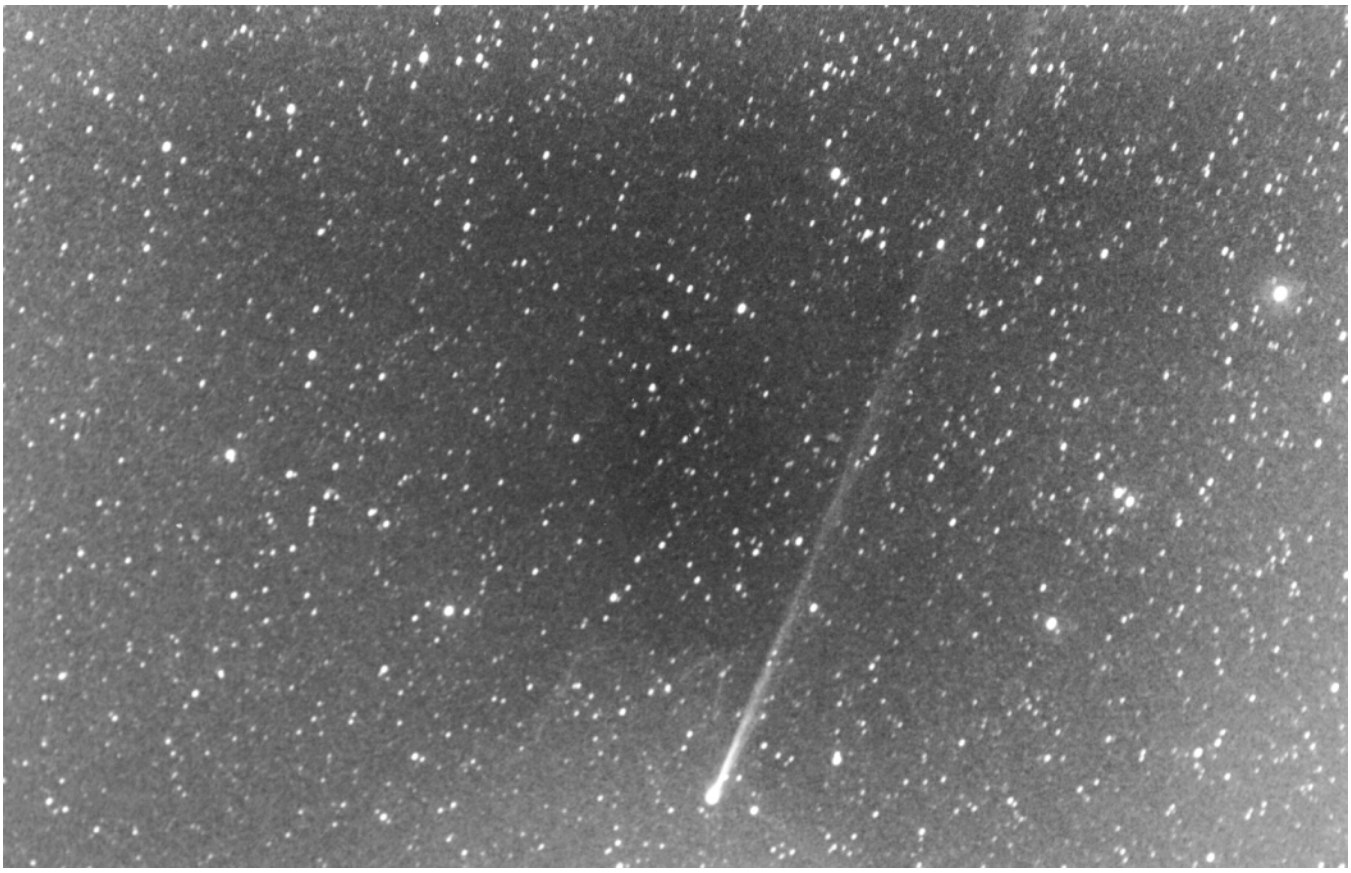
Robert C. Price

Two comets will appear in the Spring 2004 sky at the same time. Comet NEAT (C/2001 Q4) will appear in the western sky after sunset during May and June. Comet NEAT reaches its closest distance to earth, 30 million miles, on 6 May and reaches its closest distance to the Sun, 89.4 million miles, on 15 May. Comet NEAT should be at its brightest, magnitude 2.5, between 6 and 15 May. Another comet, comet LINEAR (C/2002 T7), will appear low in the southwestern sky after sunset during late May and June as it emerges from the Sun's glare in late May. Comet LINEAR reaches its closest distance to earth, 20 million miles, on 19 May and reaches its closest distance to the Sun, 57 million miles, on 23 April.

Comet NEAT was discovered on 24 August 2001 by the Jet Propulsion Laboratory's Near Earth Tracking Program (NEAT) using the 1.2 meter (48 inch) Schmidt telescope on Mount Palomar California. At discovery Comet NEAT was a 20th magnitude object in a highly elliptical orbit. Orbital calculations indicate this is NEAT's first and only pass through our solar system.

Comet LINEAR was discovered on 14 October 2002 by Lincoln Laboratory's LINEAR (Lincoln Laboratory Near-Earth Asteroid Research) survey program using its automated 1 meter telescope in Socorro, New Mexico. At discovery Comet LINEAR was a 17.5 magnitude object. Orbital calculations indicate this is LINEAR's first and only pass through our solar system.

Comet NEAT will be the easiest of the two comets to photograph. After reaching maximum brightness in May, comet NEAT will continues to climb higher in the evening sky for photographers in the northern hemisphere during the remainder of May and June. Even at the end of June NEAT will still be a 6th or 7th magnitude object. Comet LINEAR will reach its highest point above the horizon in early June and then head back towards the Sun, disappearing into the Sun's glare as it fades to the 8th magnitude by the end of June. Comet positions are provided on pages 85 and 87.



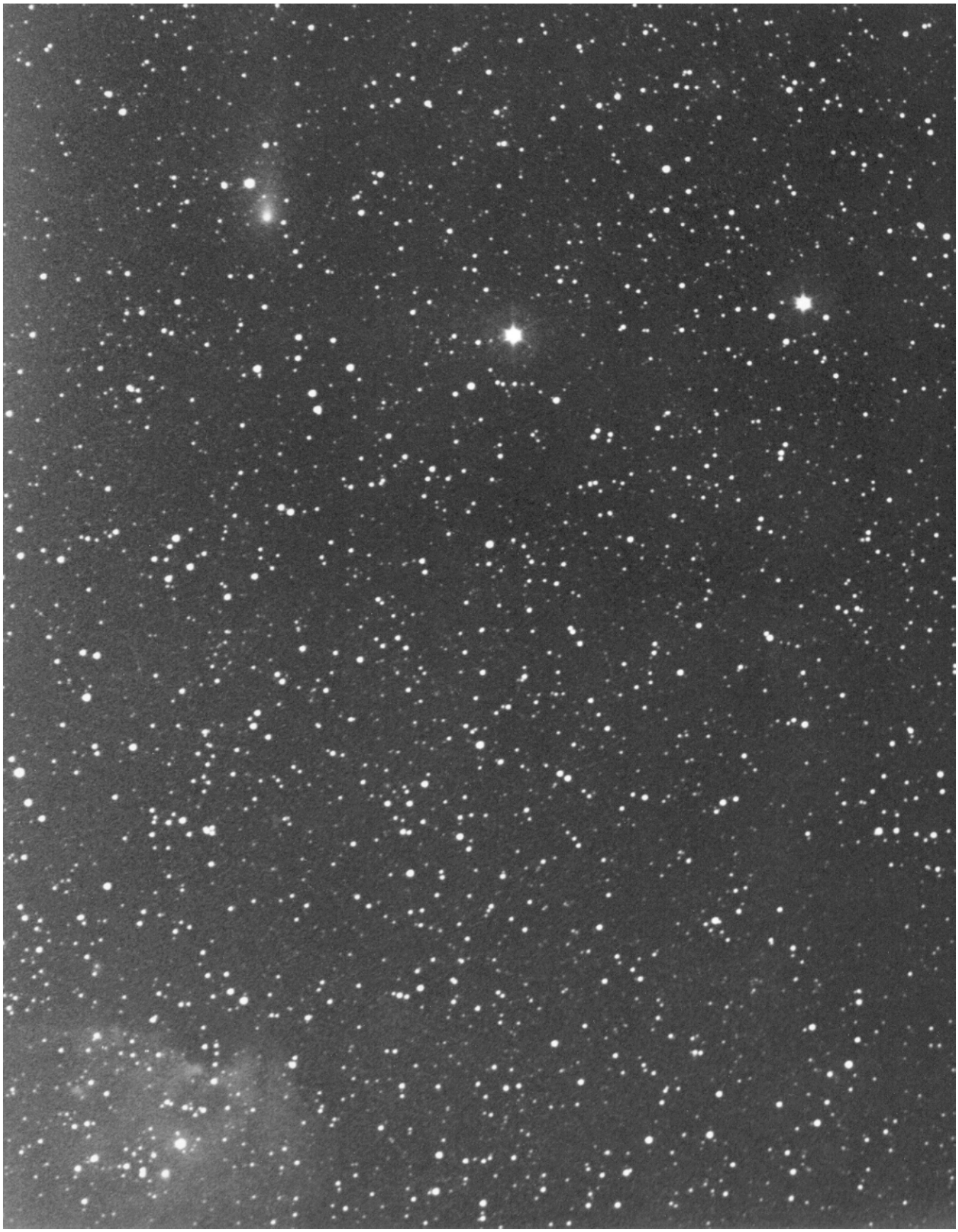
Above: Comet Brorsen-Metcalf photographed by Harvey Freed in September 1989.



Above: Comet Hale-Bopp (and M34 just below the comet) photographed by Alan McClure from the Mojave Desert on 8 April 1997 using an 85mm F/1.2 camera lens. Exposure was 2 minutes on Kodak Tri-X film developed in Microdol-X.

Comet NEAT (C/2001 Q4)

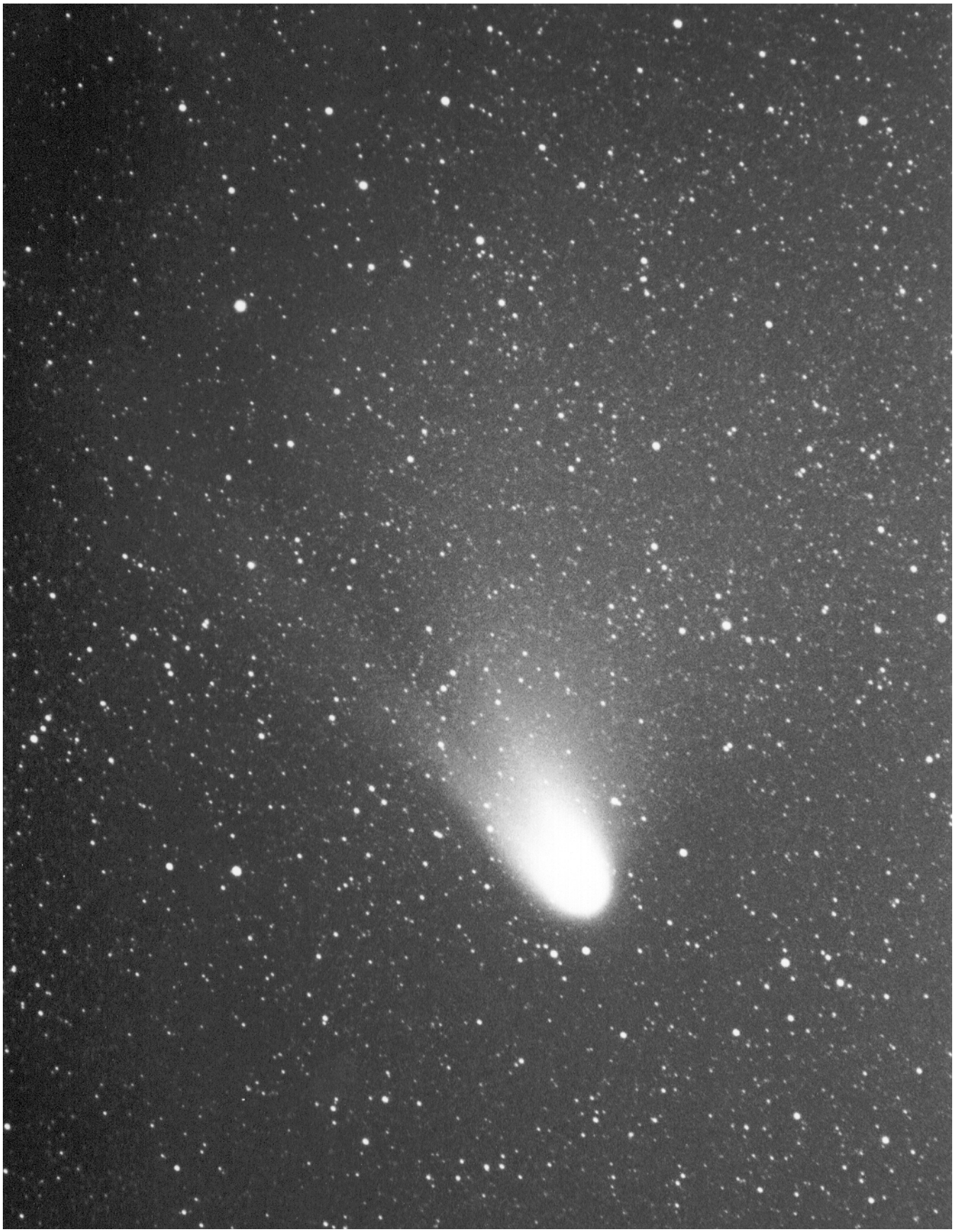
Date	Brightness	Position		Distance (in A.U) from	
		R.A.	Declination	Earth	Sun
May 01	2.9	06hr 14.5min	-44deg 14.2min	0.367	0.996
May 03	2.7	06hr 41.6min	-36deg 11.0min	0.340	0.987
May 05	2.6	07hr 06.2min	-26deg 40.3min	0.324	0.980
May 07	2.5	07hr 28.1min	-16deg 17.4min	0.320	0.974
May 09	2.5	07hr 47.4min	-05deg 55.0min	0.328	0.969
May 11	2.6	08hr 04.4min	+03deg 38.2min	0.348	0.965
May 13	2.9	08hr 19.2min	+11deg 54.3min	0.378	0.963
May 15	3.1	08hr 32.3min	+18deg 47.4min	0.416	0.962
May 17	3.3	08hr 43.7min	+24deg 25.5min	0.459	0.962
May 19	3.5	08hr 53.8min	+29deg 00.9min	0.506	0.963
May 21	3.7	09hr 02.8min	+32deg 46.3min	0.555	0.966
May 23	3.9	09hr 10.7min	+35deg 52.3min	0.607	0.970
May 25	4.1	09hr 17.9min	+38deg 27.4min	0.660	0.975
May 27	4.3	09hr 24.3min	+40deg 38.2min	0.713	0.981
May 29	4.5	09hr 30.2min	+42deg 29.7min	0.767	0.989
May 31	4.7	09hr 35.5min	+44deg 05.7min	0.820	0.998
June 02	4.8	09hr 40.4min	+45deg 29.1min	0.874	1.008
June 04	4.9	09hr 45.0min	+46deg 42.3min	0.927	1.019
June 06	5.1	09hr 49.2min	+47deg 46.9min	0.980	1.030
June 08	5.3	09hr 53.1min	+48deg 44.7min	1.032	1.043
June 10	5.5	09hr 56.9min	+49deg 36.1min	1.083	1.057
June 12	5.7	10hr 00.4min	+50deg 22.6min	1.133	1.071
June 14	5.8	10hr 03.8min	+51deg 04.8min	1.183	1.087
June 16	5.9	10hr 07.1min	+51deg 43.3min	1.232	1.103
June 18	6.0	10hr 10.3min	+52deg 18.6min	1.279	1.120
June 20	6.1	10hr 13.4min	+52deg 51.1min	1.326	1.137
June 22	6.2	10hr 16.4min	+53deg 21.3min	1.372	1.156
June 24	6.4	10hr 19.4min	+53deg 49.3min	1.416	1.175
June 26	6.6	10hr 24.1min	+54deg 08.7min	1.458	1.193
June 28	6.7	10hr 25.6min	+54deg 33.4min	1.500	1.213
July 01	6.8	10hr 23.0min	+55deg 08.0min	1.562	1.243
July 11	7.3	10hr 44.9min	+56deg 46.2min	1.748	1.352
July 21	7.7	11hr 00.8min	+58deg 08.5min	1.907	1.467
July 31	8.2	11hr 18.2min	+59deg 24.0min	2.039	1.587



Above: Periodic comet Giacobini-Zinner and NGC 2174/5 at bottom photographed by Rick Dilsizian on 13 September 1985 using an 8 inch F/1.5 Schmidt camera. Exposure was 3 minutes on hypersensitized Kodak 2415 film.

Comet LINEAR (C/2002 T7)

Date	Brightness	Position		Distance (in A.U.) from	
		R.A.	Declination	Earth	Sun
May 01	3.1	00hr 06.0min	+00deg 36.0min	0.811	0.643
May 05	2.8	00hr 20.5min	-01deg 34.1min	0.661	0.667
May 10	2.4	00hr 55.9min	-05deg 40.0min	0.476	0.716
May 15	1.9	02hr 16.6min	-12deg 42.7min	0.323	0.774
May 20	1.9	05hr 02.5min	-19deg 57.1min	0.267	0.840
May 25	2.8	07hr 33.5min	-17deg 43.6min	0.355	0.911
June 04	5.0	09hr 18.5min	-11deg 21.6min	0.695	1.061
June 09	5.8	09hr 38.5min	-09deg 49.3min	0.880	1.138
June 14	6.5	09hr 51.8min	-08deg 49.7min	1.065	1.216
June 19	7.1	10hr 01.6min	-08deg 10.2min	1.248	1.293
June 24	7.6	10hr 09.4min	-07deg 44.1min	1.427	1.371
June 29	8.1	10hr 15.9min	-07deg 27.6min	1.601	1.448
July 04	8.6	10hr 21.7min	-07deg 18.2min	1.771	1.524
July 09	9.0	10hr 26.8min	-07deg 14.1min	1.935	1.600
July 14	9.3	10hr 31.6min	-07deg 14.5min	2.093	1.675
July 19	9.7	10hr 36.1min	-07deg 18.5min	2.393	1.823
July 29	10.3	10hr 44.5min	-07deg 35.2min	2.533	1.896
August 03	10.6	10hr 48.4min	-07deg 47.0min	2.667	1.968
August 08	10.8	10hr 52.2min	-08deg 00.7min	2.794	2.040
August 13	11.1	10hr 55.9min	-08deg 16.0min	2.914	2.111
August 18	11.3	10hr 59.5min	-08deg 32.9min	3.027	2.181
August 23	11.5	11hr 03.0min	-08deg 51.0min	3.133	2.251
August 28	11.7	11hr 06.3min	-09deg 10.2min	3.232	2.319
September 02	11.9	11hr 09.6min	-09deg 30.5min	3.324	2.388
September 07	12.1	11hr 12.7min	-09deg 51.6min	3.408	2.455
September 12	12.2	11hr 15.8min	-10deg 13.4min	3.484	2.522
September 17	12.4	11hr 18.7min	-10deg 35.9min	3.553	2.588
September 22	12.5	11hr 21.4min	-10deg 59.0min	3.615	2.654
September 27	12.7	11hr 24.0min	-11deg 22.5min	3.669	2.719
October 02	12.8	11hr 26.5min	-11deg 46.3min	3.715	2.784
October 07	13.0	11hr 28.7min	-12deg 10.4min	3.755	2.848
October 12	13.2	11hr 30.8min	-12deg 34.6min	3.786	2.912
October 17	13.3	11hr 32.7min	-12deg 58.9min	3.811	2.975
October 22	13.4	11hr 34.4min	-13deg 23.1min	3.829	3.038



Above: Comet Hale-Bopp photographed by Rick Dilsizian on 13 February 1997 using a 200mm F/2.8 camera lens with minus violet filter. Exposure was 5 minutes on hypersensitized Kodak 2415 film.



Above: Comet Hale-Bopp photographed by Rick Dilsizian on 2 April 1997 using a 200mm F/2.8 camera lens with minus violet filter. Exposure was 5 minutes on hypersensitized Kodak 2415 film.

Astrophotography for June and July

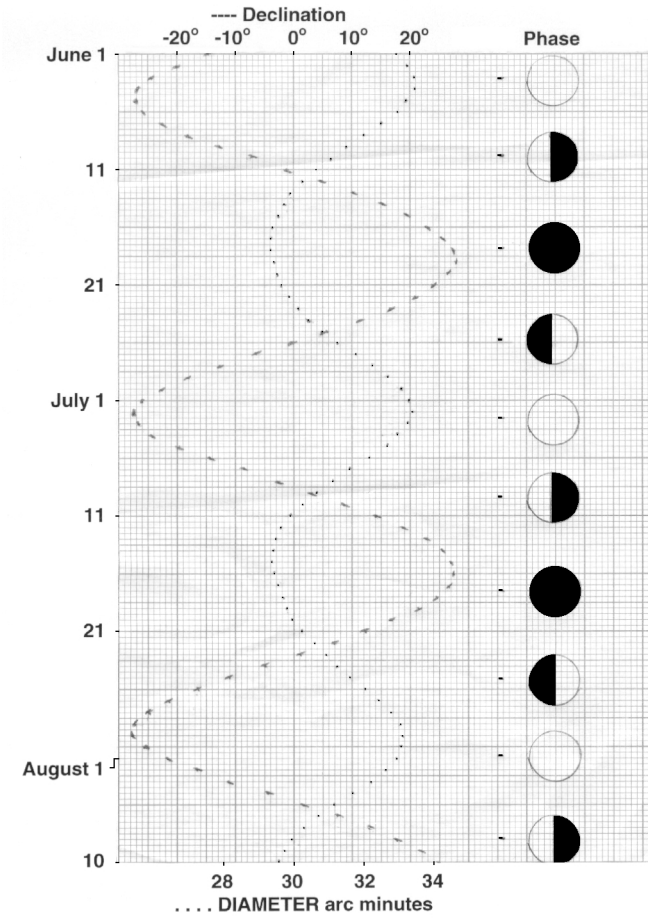
by

Ralph Proctor

Mercury begins June as a morning object low in the eastern sky, and moves lower in the eastern sky until it disappears into the Sun's glare during the second week in June. Mercury reaches superior conjunction with the Sun on 18 June and re-emerges from the Sun's glare as an evening object during the last week in June. Mercury reaches a greatest eastern elongation of 27 degrees on 27 July when it will be in fair photographic position with a declination of +10 degrees.

Venus begins June lost in the Sun's glare but emerges from the Sun's glare in mid-June as a morning object low in the eastern sky. Venus will be in excellent photographic position at the end of July and will be positioned high in the eastern sky.

Lunar Declination and Diameter:



The Moon's crescent phases will be located high on the ecliptic and in excellent photographic position during June (June 19) and July (July 16), with an apparent declination of up to +27 degrees.

Mars begins June as an evening object low in the western sky in the constellation Taurus, but moves quickly into the constellation Gemini, Cancer, and Leo in late July. During June and July Mars moves lower in the western sky, remains constant in brightness at magnitude +1.8 and decreases in diameter from to 3.96 to 3.57 arc seconds.

Jupiter begins June as an evening object in the western sky in the constellation Leo. During June and July Jupiter moves lower in the western sky, but is still well placed for photography with a declination of +9 to +6 degrees. During June and July Jupiter decreases in brightness from magnitude -2.0 to -1.7, and decreases in diameter from 36.9 to 32.0 arc seconds.

Saturn begins June as an evening object low in the western sky in the constellation Gemini. During June Saturn moves lower in the western sky until it disappears into the Sun's glare during the last week in June. Saturn reaches conjunction with the Sun on 8 July and emerges from the Sun's glare in late July as a morning object low in the eastern sky. During June and July Saturn remains constant in brightness at magnitude +0.1, and decreases in diameter from 16.8 to 16.6 arc seconds.

Uranus begins June as a morning object high in the eastern sky in the constellation Aquarius. During June and July Uranus moves higher in the eastern sky, increases in brightness from magnitude +5.8 to +5.7, and increases in diameter from 3.53 to 3.68 arc seconds. Uranus is located at R.A. 22 hours 35.3 minutes declination -09 degrees 44 minutes on 15 June and at R.A. 22 hours 33.6 minutes declination -09 degrees 55 minutes on 15 July.

Neptune begins June as a morning object high in the eastern sky in the constellation Capricornus. During June and July Neptune moves higher in the eastern sky, increases in brightness from magnitude +7.9 to +7.8, and increases in diameter from 2.31 to 2.35 arc seconds. Neptune is located at R.A. 21

hours 10.7 minutes declination -16 degrees 20 minutes on 15 June and at R.A. 21 hours 08.3 minutes declination -16 degrees 32 minutes on 15 July.

Pluto begins June as a morning object high in the eastern sky. Pluto reaches opposition on 11 June when it will be located in poor photographic position with a declination of minus 14 degrees. During June and July Pluto remains constant in brightness at magnitude +13.8. Pluto is located at R.A. 17 hours 22.5 minutes declination -14 degrees 14 minutes on 15 June and at R.A. 17 hours 19.4 minutes declination -14 degrees 16 minutes on 15 July.

Events:

Vesta will be occulted by the Moon on 12 July (22 hours Universal Time) for most of New Zealand, the southeastern Pacific Ocean, and most of Antarctica.

Venus will transit the Sun on 8 June. The entire transit will be visible from all but the eastern portion of Asia, all but the western portion of Africa, all but the Iberian Peninsula of Europe, all but the southern tip of Greenland, and the Indian Ocean. Ingress exterior contact occurs at 05 hours 13.5 minutes Universal Time. Ingress interior contact occurs at 05 hours 32.8 minutes Universal Time. Egress interior contact occurs at 11 hours 06.6 minutes Universal Time. Egress exterior contact occurs at 11 hours 25.9 minutes Universal Time.

Moon will undergo a total eclipse on 25 October for the Arctic region, western Russia, Arabia, Africa, Madagascar, parts of Antarctica, Europe, Greenland, North America, Central America, South America, the eastern Pacific ocean, and the southern tip of Siberia. The Moon enters and leaves the penumbra at 00 hours 05.5 minutes and 06 hours 02.7 minutes Universal Time respectively. The Moon enters and leaves the umbra at 01 hours 14.3 minutes and 04 hours 53.7 minutes Universal Time respectively. The Moon enters and leaves totality at 02 hours 23.4 minutes and 03 hours 44.6 minutes Universal Time respectively. Mid-eclipse occurs at 03 hours 04.0 minutes Universal Time.

MINOR PLANETS

		Position			
		15 June		15 July	
Planet	Magnitude	R.A.	Decl.	R.A.	Decl.
Ceres	08.7 - 08.6	09 hr 02.1 min	+25 deg 10 min	09 hr 54.1 min	+20 deg 58 min
Pallas	09.1 - 08.9	06 hr 00.5 min	-00 deg 20 min	07 hr 06.6 min	-00 deg 08 min
Juno	10.2 - 9.8	19 hr 24.2 min	-04 deg 50 min	18 hr 59.6 min	-05 deg 25 min
Vesta	07.6 - 06.7	23 hr 40.6 min	-08 deg 02 min	00 hr 04.7 min	-07 deg 43 min

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The Constellation Ophiuchus

by

Robert C. Price

The constellation Ophiuchus crosses the meridian at about midnight in mid-July. Ophiuchus is a large constellation located just north of the constellations Scorpio and Sagittarius. From east to west it is 2 hours 45 minutes in extent, from right ascension 18 hours 45 minutes to 16 hours 00 minutes. In declination it varies from plus 10 degrees 20 minutes north declination to minus 30 degrees 10 minutes south declination. On the north it borders Hercules, on the east Serpens, and on the west Scorpius. The constellation contains a number of galactic clusters, globular clusters, planetary nebulae, diffuse nebulae, and dark nebulae. Ophiuchus is located in a very rich region of the Milky Way and close to the Milky Way's center. Some objects of photographic interest are listed in the table on page 95.

Alpha Ophiuchi, Ras Alhague, is a nearby star 60 light years distance. It shows the same spacer motion as stars in the Ursa Major group. The star shows a 8.5 year periodic oscillation caused by an unseen companion estimated to be .6 solar masses.

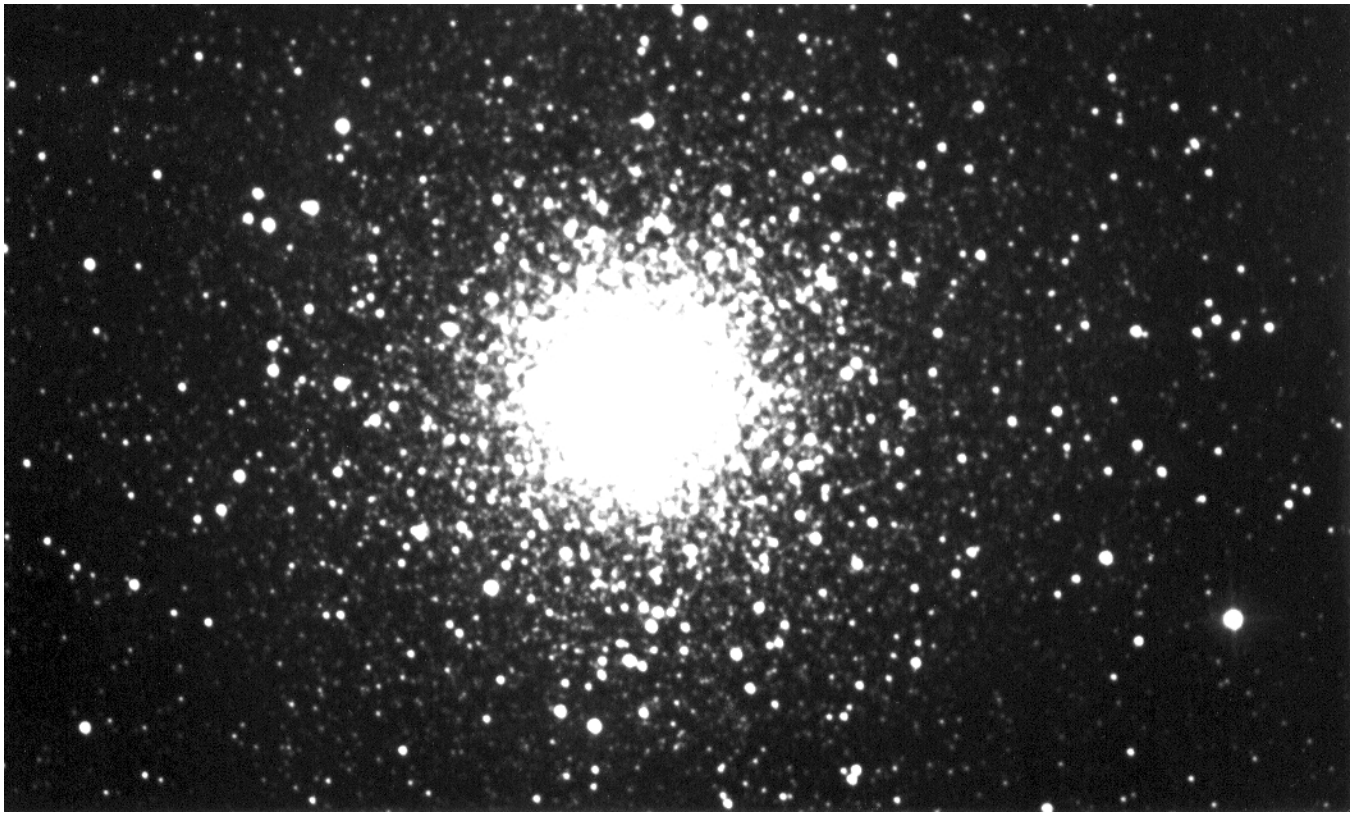
Theta Ophiuchi is a spectroscopic variable of the Beta Canis Majoris type with a period of 3.37 hours.

U Ophiuchi is an eclipsing binary star consisting of two almost identical B-type stars whose combined magnitude of 5.5 falls to 6.7 during the eclipse.

X Ophiuchi is a long-period Mira-type variable star with a 334 day period and a brightness variation from magnitude 6 to magnitude 9.

Barnard's Star is a fast moving star that is known to have periodic variations in its motion that indicate an unseen Jupiter size planet located at a distance of 4 astronomical units.

M9 is a small bright globular cluster and one of the closest to the galactic nucleus, 7500 light years from the nucleus. M9 is located 3.5 degrees southeast of Eta Ophiuchi and about 26,000 light years from



Above: Globular cluster M10 photographed by Martin Germano on 14 April 1996 from Mt Pinos CA using a 14.5 inch F/5 Newtonian with comma corrector and ST-4 autoguider. Exposure was 65 minutes on hypersensitized Kodak 2415 film developed 6 minutes in D-19 at 68°F. Enlargement is approximately 15 times.

Earth. Two smaller globular clusters NGC 6342 and NGC 6356 are located 1.2 degrees to the southeast and northeast respectively.

M10 is double globular cluster with M12 located 3.4 degrees apart. M10 is a bright 7th magnitude cluster with a compressed center and is located at an estimated distance of 22,000 light years.

M12 with M10 are a visual double cluster. M12 is a loose cluster, far less condensed than M10 but is located at about the same distance as M10. Its actual distance from M10 is about 2,000 light years.

M14 is a globular cluster that consists of a smooth grouping of 15th magnitude and fainter stars. A nova appeared in this cluster in 1938, a rare event for a globular cluster. Estimated distance to this cluster is 70,000 light years.

M19 is another globular cluster that is close to the center of the galaxy, an estimated 3,000 light years from the center. M19 consists of numerous 14, 15, and 16 magnitude stars in a noticeably oblate disk. M19 is located at an estimated distance of 20,000 light years. Just southeast of M19 lies the Pipe Nebula, an irregular shaped dark nebula where only a few stars can be photographed.

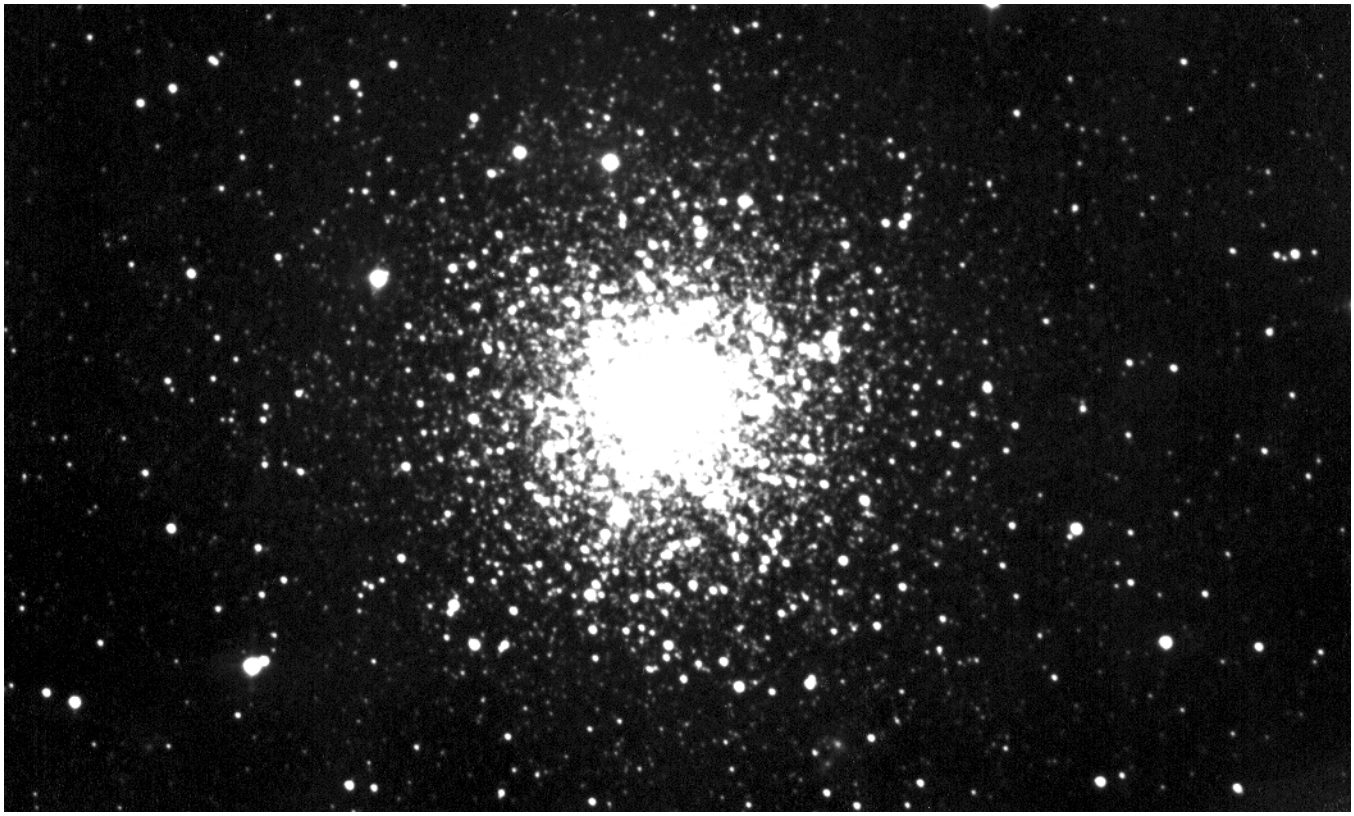
B 72 is a dark S-shaped nebula located 1.5 degrees north-northeast from Theta Ophiuchi. It is about 30 minutes in diameter.

NGC 6572 is a beautiful small bright bluish-green planetary nebula with a 12th magnitude O-type central star.

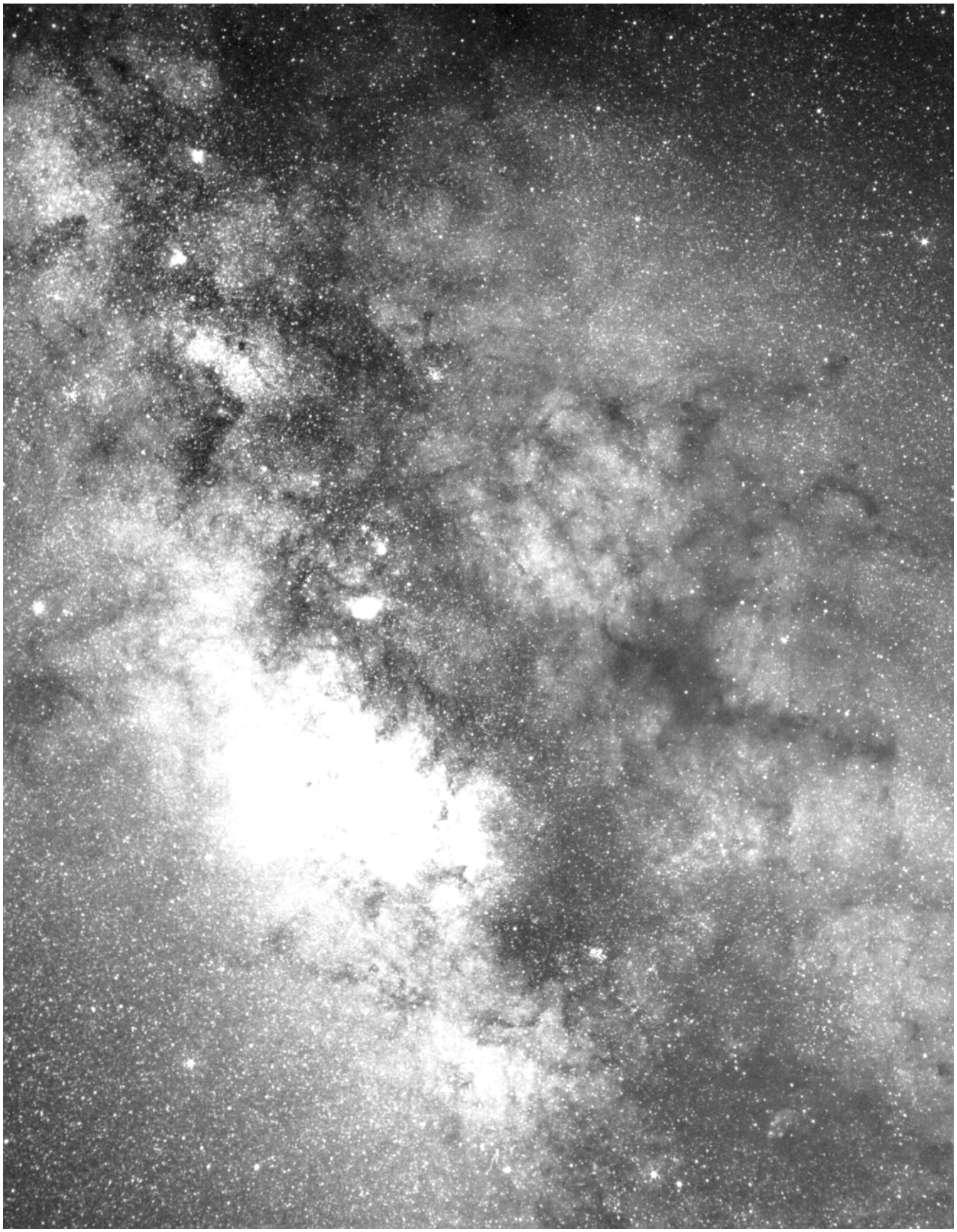
NGC 6369 is a dim but perfectly shaped small planetary nebula with a 16th magnitude central star.

NGC 6309 is an 11th magnitude planetary nebula with a 14th magnitude central star.

The Milky Way's central hub lies on the Sagittarius/Ophiuchus border. The center of the Milky Way lies just across the border in Sagittarius at R.A. 17 hours 42.4 minutes, declination minus 28 degrees 59 minutes.



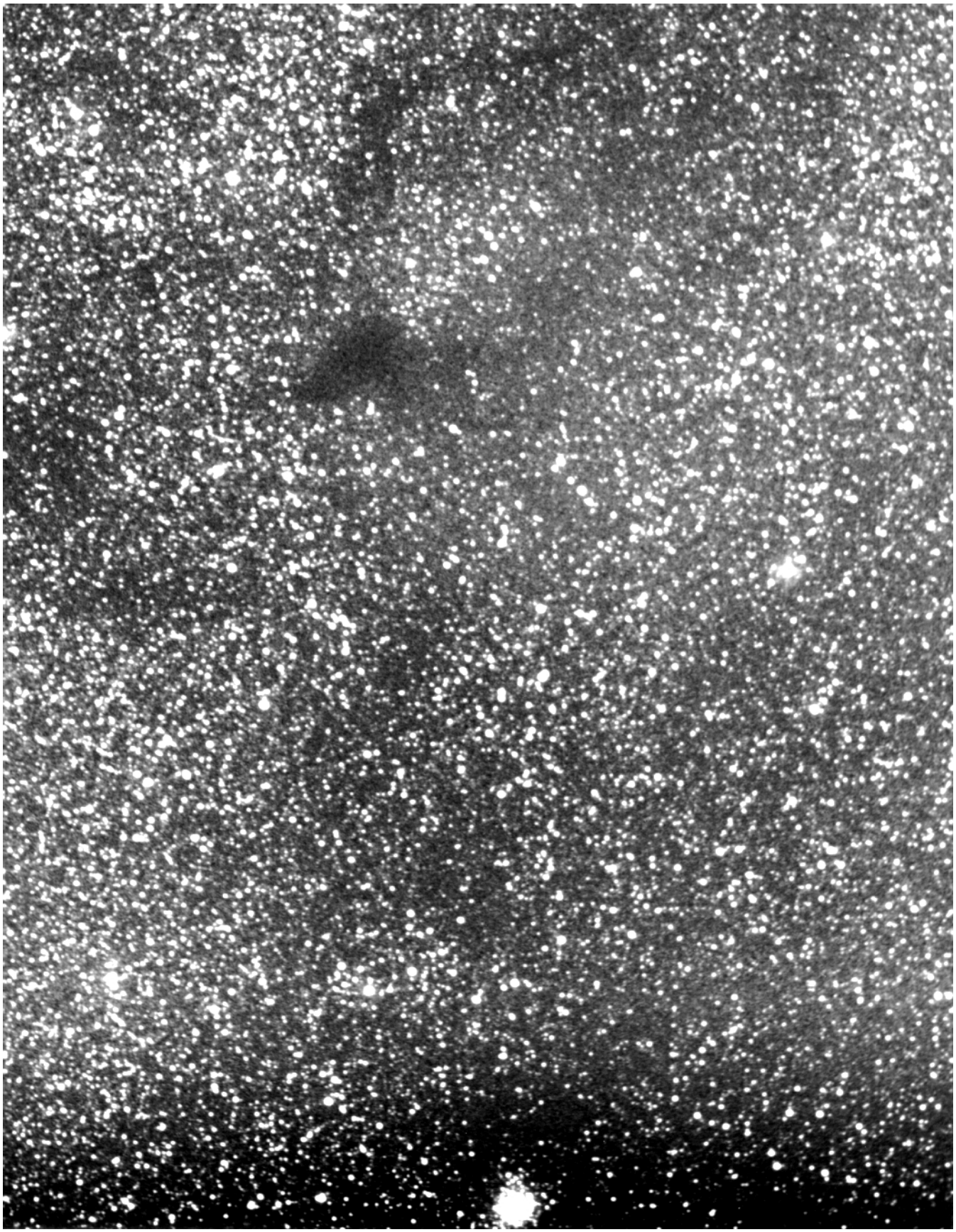
Above: Globular cluster M12 photographed by Martin Germano on 19 March 1996 from Figueroa Peak CA using a 14.5 inch F/5 Newtonian with comma corrector and ST-4 autoguider. Exposure was 60 minutes on hypersensitized Kodak 2415 film developed 6 minutes in D-19 at 68°F. Enlargement is approximately 15 times.



Above: Sagittarius and Ophiuchus area (M8 is center left and dark nebulae in Ophiuchus center right) photographed by Martin Germano on 9 August 1986 from Mc Phearson Peak CA using a 50mm F/4 camera lens. Exposure was 30 minutes on hypersensitized Kodak 2415 film developed 5.5 minutes in D-19 at 68°F. Enlargement is approximately 9 times.

OBJECTS FOR ASTROPHOTOGRAPHY IN OPHIUCHUS

Object	Mag.	Size.	R.A.	Declation	Description
I.4604		140'x70'	16hr 22.6min	-23deg 20min	Irregular diffuse nebula surrounding 4th magnitude star Rho Ophiuchi.
NGC6171		4' dia	16hr 29.7min	-12deg 57min	Globular star cluster with 14th magnitude stars.
NGC6218	8	10'dia	16hr 44.6min	-01deg 52min	M12 globular star cluster with llth mag. stars.
NGC6235	10	2' dia	16hr 50.4min	-22deg 05min	Globular star cluster with 14th magnitude stars.
NGC6254	7	8' dia	16hr 54.5min	-04deg 02min	M10 Globular star cluster with 11-15th mag. stars.
1.4634	12	20"x10"	16hr 58.5min	-21deg 44min	Planetary nebula with 17th magnitude central star.
NGC6273	7	6' dia	16hr 59.5min	-26deg 11min	M19 Globular star cluster with 14-16th mag. stars.
NGC6284	10	2' dia	17hr 01.5min	-24deg 41min	Globular star cluster with 15th magnitude stars.
NGC6287	10	2' dia	17hr 02.1min	-22deg 38min	Globular star cluster with 16th magnitude stars.
NGC6293	8	2' dia	17hr 07.1min	-26deg 30min	Globular star cluster with 16th magnitude stars.
B57		5'	17hr 08.3min	-22deg 50min	Dark nebula.
NGC6304	9	2' dia	17hr 11.4min	-29deg 24min	Globular star cluster with 1lth magnitude stars.
NGC6309	11.5	20"x10"	17hr 11.2min	-12deg 51min	Planetary nebula with a 14th mag. central star.
NGC6316	10	l' dia	17hr 13.4min	-28deg 05min	Globular star cluster.
NGC6325	12	l' dia	17hr 15.0min	-23deg 42min	Globular star cluster.
NGC6333	8	4' dia	17hr 16.2min	-18deg 28min	M9 Globular star cluster with 14th mag. stars.
NGC6342	11	l' dia	17hr 18.2min	-19deg 32min	Globular star cluster.
NGC6355	10	l' dia	17hr 20.9min	-26deg 19min	Globular star cluster.
NGC6356	8.5	2' dia	17hr 20.7min	-17deg 46min	Globular star cluster.
B72		30'dia	17hr 21.0min	-23deg 35min	S-shaped dark nebula l.5° north-northwest from Theta Ophiuchi.
I.1257	?	l' dia	17hr 24.5min	-07deg 03min	Faint galactic star cluster.
NGC6366	12	4' dia	17hr 25.1min	-05deg 02min	Globular star cluster.
H15	9	10' dia	17hr 26.0min	-29deg 29min	Galactic star cluster with 15 faint stars.
NGC6369	11	28" dia	17hr 26.3min	-23deg 44min	Planetary nebula with a 16th mag. central star.
NGC6384	12.3	4.0'x3.0'	17hr 29.9min	+07deg 06min	Spiral galaxy.
NGC6401	11	l' dia	17hr 35.6min	-23deg 53min	Globular star cluster.
NGC6402	9	6' dia	17hr 35.9min	-03deg 18min	M14 globular star cluster with 15th mag. stars.
NGC6426	12	2' dia	17hr 42.4min	+03deg 12min	Globular star cluster.
I.4665	6	55' dia	17hr 43.8min	+05deg 44min	Galactic star cluster with twenty 7th mag. stars.
NGC6517	12	l' dia	17hr 59.1min	-08deg 57min	Globular star cluster.
NGC6572	9	15"x12"	18hr 09.7min	+06deg 50min	Blue-green planetary nebula with 12th magnitude central star.
NGC6638	5	20'dia	18hr 25.1min	+06deg 32min	Galactic star cluster with 65 7th magnitude stars.



Above: Dark nebula B57 in Ophiuchus and globular cluster NGC 6287 (bottom) photographed by Martin Germano on 21 June 1990 from Mt Pinos CA using an 8 inch F/5 Newtonian with comma corrector. Exposure was 65 minutes on hypersensitized Kodak 2415 film developed 6 minutes in D-19 at 68°F. Enlargement is approximately 9 times.