the ASTROGRAPH



Volume 36 No. 6 June/July 2005

the ASTROGRAPH

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COVER PHOTOGRAPH

Object.....NGC 7000, the North American Nebula

Photographer.....Lee C. Coombs

Instrument.....70mm F/5.1 Tele Vue Pronto

Exposure\Film.....60 minutes/Kodak Ektachrome P200

Date.....11 August 1999

VOLUME 36 No. 6

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Features

Long Exposure Image Defects in Digital SLRs 83
Dark Frame Subtraction.....86
The Constellation Sagittarius.....92

Departments

Astrophotography for June and July.....90

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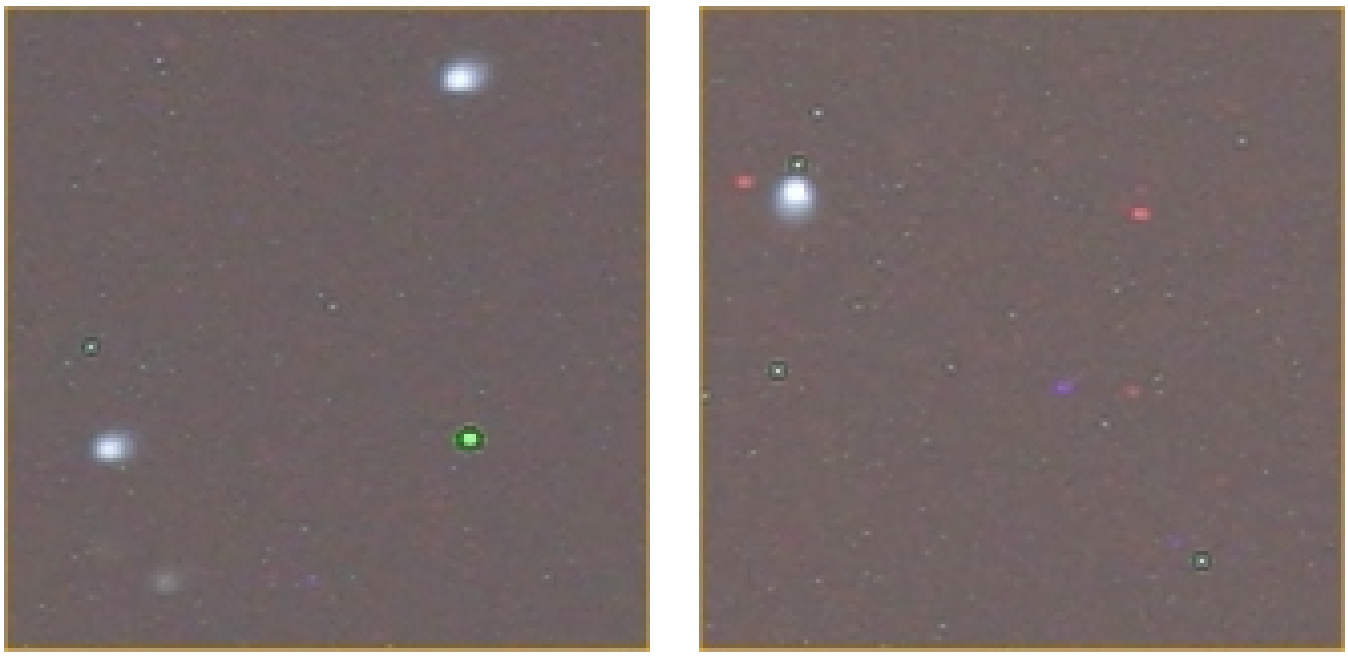
Long Exposure Image Defects in Digital SLRs

by

Robert C. Price

The heart of the modern digital camera is the CMOS or CCD sensor array. This array consists of, in the case of the Canon 300D, over 6 million photosites that are light sensitive. Each photosite also contains an electronic amplifier that amplifies the faint electrical signal. Long exposure image defects in digital SLRs are not visible in normal short exposures taken with these same cameras. In normal photography the exposures are so short that the electron noise that occurs within the image sensor and its associated processing does not have enough time to build up to the point of being noticeable when compared to the image levels of normally exposed scenes. As the exposure is increased beyond a few seconds this electronic noise does increase and with exposures of several minutes does become very noticeable, especially if the image is that of a dark sky with a large amount of dark space between stars. This electron noise is also called dark noise because it is present even when no image is falling on the sensor. Dark noise is not random and occurs at the same photosite on the sensor. Dark noise is heat-generated and it is also temperature dependent. The higher the temperature the more dark noise will occur. Dark noise is also dependent on exposure; double the exposure and the dark noise is also doubled. With a given ISO setting, temperature, and exposure, the dark noise within images should be similar. There are two type of noise defects that are noticeable with long exposure astronomical photography. The brightest defect is called a hot pixel. Hot pixels are caused by high rate charge leakage at specific photosites. With the author's Canon 300D this defect appears as a single very bright green pixel surrounded by additional bright green pixels, and this green defect is surrounded by dark pixels. The second type of defect is a soft elongated color ellipse. This ellipse is usually colored red but about 30 percent of the time is colored blue. Both types of defects appear at fixed locations. The locations of both these defects do vary somewhat with time and temperature, but not to the extent that images taken during the same night will contain any noticeable variation in the position of these defects. The images on pages 83, 84 and 85 show typical Canon 300D long exposure image defects.



Above: Magnified view of hot pixels, shown above in both images. Two large red and one large blue defect are shown on right. Images are from same image file shown on pages 84 and 85. The large white round objects are stars.



Above: M51 photographed by the author on 9 May 2005 using a Canon 300D and 8 inch F/5 Newtonian. Exposure was 10 minutes at 400ASA. Shown above is the full frame raw image with no processing.



Above: Same image as on top of page but with level and color corrections done in Adobe PhotoShop Elements 2. Numerous defects are visible throughout the frame even at this low enlargement level.



Above: Same image as on top of page 84 but magnified and centered on M51. Note numerous hot pixels and red and blue defects.



Above: Same image as on bottom of page 84 but magnified and centered on M51. Note that the numerous hot pixels and red and blue defects are far more evident after the image level is adjusted.

Dark Frame Subtraction

by
Robert C. Price

In the February/March 2005 issue the author discussed dark frame subtraction using the application Q Image to reduce defects in images taken with CCD and CMOS image sensors and specifically with the Canon 300D. As was noted in this article the process did not completely work on hot pixel defects. Since that article the author has come across two programs, one designed specifically for hot pixel reduction and one specifically for dark frame subtraction. Both programs are free and can be obtained from Mediachance.com. As was the case with the Q Image program both the Mediachance Hot Pixel Elimination and dark frame (called BlankFrame NR) reduction do not totally eliminate the hot pixel without leaving some type of artifact such as a dark spot, but they do work better than the Q Image program and they are far easier to use. Figure 1 shows the results of running the Hot Pixel Elimination program on the author's 10 minute exposure of M51. Note that the center of the hot pixel has been eliminated, but adjacent bright pixels are not suppressed, and negative pixels that are 2 pixels away from the bright pixel, and form an "O", are also not affected. The BlankFrame NR program has 4 options. Simple subtraction does not seem to work very well even when both the long exposure astronomical image and the blank frame image are identical exposures. With simple subtraction the final image contains numerous negative image defects that appear to be at locations where a defect is present on the dark frame but not at that location on the astronomical exposure. The three other options "stochastic selective", "stochastic selective 2 pass", and "SS 2 pass + purple fringing" all seem to eliminate these negative defects. Figure 2 shows the result of running both the Hot Pixel Elimination program and the BlankFrame NR program. Note there are still some red defects and negative defects where bright hot pixels were located. Compared to the image on the top of page 85 most defects are gone. Figure 3 is this same image as Figure 2 with levels and color adjustments, as well as the clone tool to touch up remaining defects. In order for subtraction programs such as BlankFrame NR to work properly they must use non-compressed file formats such as .tif.



Above: Figure 1, same image as on top of page 84 but magnified, centered on M51, and HotPixels Eliminator program from Mediachance.com run on raw unprocessed image.



Above: Figure 2, same image as on page 86 but the BlackFrame NR program from Mediachance.com was run on the image that was processed using the HotPixels Eliminator program.



Above: Figure 3, same image as on the top of this page but with level and color corrections made using Adobe PhotoShop Elements 2. The clone tool was then used to touch up any remaining defects and hot pixels.



Above: Globular star cluster M22 photographed by Lee C. Coombs on 13 August 2001 using a 10 inch F/5 Newtonian. Exposure was 30 minutes on Kodak Ektachrome Professional 200 slide film.



Above: Globular star cluster M13 photographed by Lee C. Coombs on 13 May 2001 using a 10 inch F/5 Newtonian. Exposure was 30 minutes on Kodak Ektachrome Professional 200 slide film.

Astrophotography for June and July

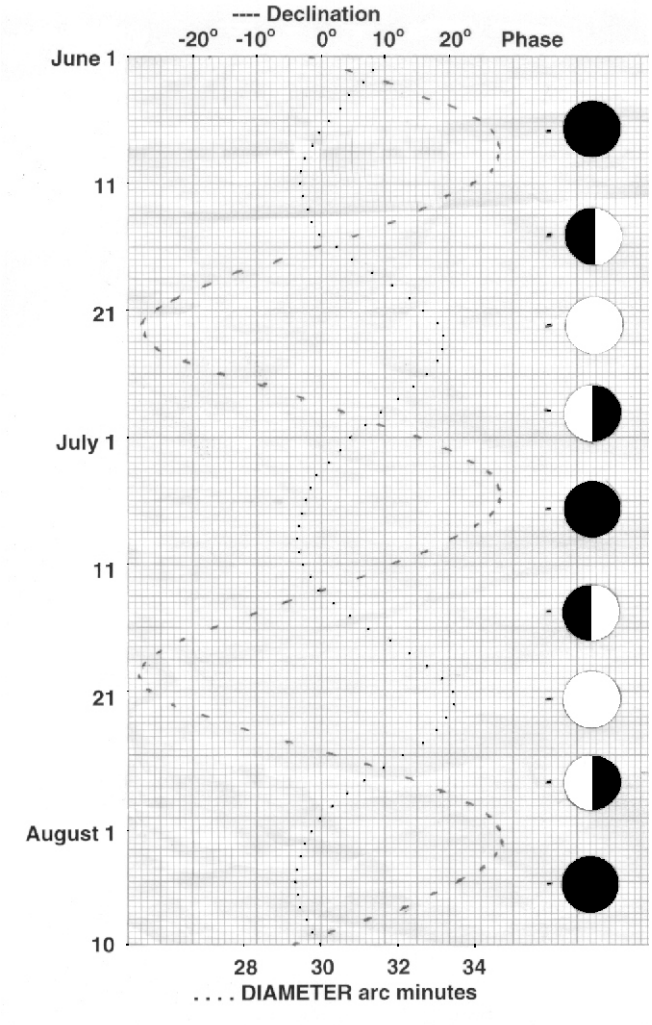
by

Ralph Proctor

Mercury begins June lost in the Sun's glare, but emerges from the Sun's glare in early to mid-June as an evening object low in the western sky. Mercury reaches a greatest eastern elongation of 26 degrees on 9 July when it will be in good photographic position with a declination of plus 17 degrees. During July Mercury moves lower in the eastern sky and disappears into the Sun's glare at the end of July.

Venus begins June as an evening object low in the western sky. During June and July Venus climbs slightly higher in the western 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 8) and July (July 6), with an apparent declination of up to +28 degrees.

Mars begins June as a morning object in the eastern sky in the constellation Aquarius , but moves into the constellation Pisces in early June. During June and July Mars moves higher in the eastern sky, increases in brightness from magnitude +0.3 to -0.4, and increases in diameter from 7.82 to 11.23 arc seconds.

Jupiter begins June as an evening object high in the western sky in the constellation Virgo, having reached opposition with the Sun on 3 April. During June and July Jupiter moves lower in the western sky, decreases in brightness from magnitude -2.2 to -1.8, and decreases in diameter from 40.4 to 35.0 arc seconds.

Saturn begins June as an evening object low in the western sky in the constellation Gemini. Saturn moves into the constellation Cancer in early July, just before it disappears into the Sun's glare. During June and July Saturn moves lower in the western sky, remains constant in brightness at magnitude +0.2 , and decreases in diameter from 17.0 to 16.5 arc seconds.

Uranus begins June as a morning object high in the eastern sky in the constellation Aquarius. During June and July Uranus increases in brightness from magnitude +5.8 to +5.7, and increases in diameter from 3.52 to 3.67 arc seconds. Uranus is located at R.A. 22 hours 50.2 minutes declination -8 degrees 15 minutes on 15 June and at R.A. 22 hours 48.9 minutes declination -8 degrees 24 minutes on 15 July

Neptune begins June as a morning object high in the eastern sky in the constellation Capricornus. Neptune reaches opposition with the Sun on 8 August. During June and July Neptune increases in brightness from magnitude + 7.9 to + 7.8, and increases in diameter from 2.30 to 2.35 arc seconds. Neptune is located at R.A. 21 hours 19.7 minutes declination -15 degrees 44 minutes on 15 June and

at R.A. 21 hours 17.4 minutes declination -15 degrees 55 minutes on 15 July.

Pluto begins June as a morning object high in the eastern sky. On 15 June Pluto reaches opposition with the Sun. During June and July Pluto decreases in brightness from magnitude +13.8 to +13.9. Pluto is located at R.A. 17 hours 31.6 minutes declination -14 degrees 59 minutes on 15 June and at R.A. 17 hours 28.6 minutes declination -15 degrees 02 minutes on 15 July.

Events:

Jupiter will be occulted by the Moon on 16 June (07 hours Universal Time) for Indonesia, the Philippines, northern Australia, Fuji, western Samoa, and all but the southern tip of New Zealand on 13 July (18 hours Universal Time) for all but the northern portion of South America, and part of Antarctica.

Antares will be occulted by the Moon on 20 June (18 hours Universal Time) for southeastern Europe, most of Arabia, southern and central Asia, and the northern Philippines; and on 18 July (04 hours Universal Time) for the northeastern Pacific Ocean, the southern and western portions of the United States, America, the Caribbean, and the northern portion of South America.

The Sun will undergo an annular eclipse on 3 October for eastern Greenland, Iceland, all Europe except the British Isles, all but the southern tip of Africa, western Asia, and India. The eclipse begins and ends at 7 hours 35.5 minutes and 13 hours 27.8 minutes Universal Time respectively. Central eclipse at local apparent noon occurs at 10 hours 10.7 minutes Universal Time.

The Moon will undergo a partial eclipse on 17 October for parts of Antarctica, Australasia, central and eastern Asia, all but the eastern portion of North America, and Central America. The Moon enters and leaves the penumbra at 09 hours 51.4 minutes and 14 hours 15.1 minutes Universal Time respectively. The Moon enters and leaves the umbra at 11 hours 34.0 minutes and 12 hours 32.5 minutes Universal Time respectively. Mid-eclipse occurs at 12 hours 03.3 minutes Universal Time.

MINOR PLANETS

		position			
		15 June		15 July	
Planet	Magnitude	R.A.	Decl.	R.A.	Decl.
Ceres	07.4 - 08.5	14 hr 44.2 min	-09 deg 20 min	14 hr 44.7 min	-11 deg 47 min
Pallas	08.8 - 09.6	12 hr 24.4 min	+19 deg 58 min	12 hr 53.9 min	+17 deg 12 min
Juno	10.0 - 09.5	02 hr 02.1 min	+08 deg 42 min	03 hr 02.5 min	+11 deg 04 min
Vesta	08.3 - 08.5	04 hr 14.5 min	+17 deg 40 min	05 hr 12.0 min	+19 deg 33 min

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Volume No. 12 issue 1, 2, 3, 4, 5, and 6
Volume No. 13 issue 1, 2, 3, 4, 5, and 6
Volume No. 14 issue 1, 2, 3, 4, 5, and 6
Volume No. 15 issue 1, 2, 3, 4, 5, and 6
Volume No. 16 issue 1, 2, 3, 4, 5, and 6
Volume No. 17 issue 1, 2, 3[2], 4, 5, and 6
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The Constellation Sagittarius

by

Robert C. Price

The constellation Sagittarius crosses the meridian just after midnight in early June. Sagittarius is a large constellation located just north of the constellations Corona Australis and Telescopium. From east to west Sagittarius is 2 hours 40 minutes in extent, from right ascension 17 hours 45 minutes to 20 hours 25 minutes. In declination it varies from 45 degrees south declination to 12 degrees south declination. On the north it borders Serpens, Scutum, and Aquila, on the east Capricornus and Microscopium, and on the west Ophiuchus and Scorpius. The constellation contains a number of diffuse nebula, galactic star clusters, globular star clusters, and planetary nebula. It is rich in these objects because the Milky Way cuts across almost the entire constellation. Some objects of photographic interest are listed in the table on page 93.

Epsilon Sagittarii, Kaus Australis, is the brightest star in Sagittarius at magnitude 1.81 and is located at a distance of 125 light years.

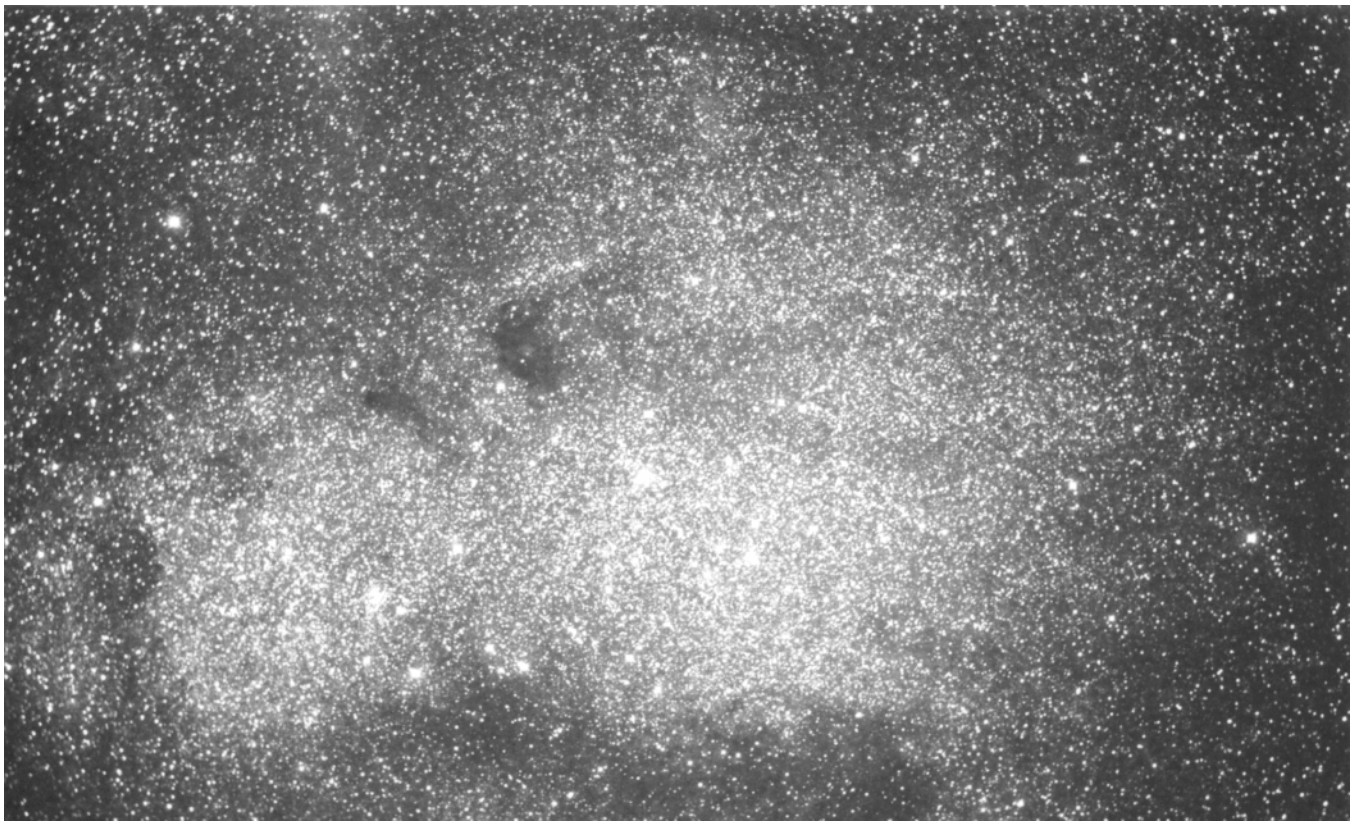
M8, the Lagoon Nebula, is a large naked eye diffuse nebula that envelopes the open cluster NGC 6530. Estimated distance to this nebula is 3000 light years.

M17, the Swan Nebula, is another large diffuse nebula that has some 35 stars associated with it. Estimated distance to this nebula is 5700 light years.

M20, the Trifid Nebula, is yet another large diffuse nebula in Sagittarius. Photographically it consists of two components with contrasting colors. The southern component is H-alpha red while the northern component is blue, an unusual color for a diffuse nebula.

M22 is a giant globular cluster, one of the best in the sky. It is estimated to contain over 75,000 member stars. Estimated distance to this cluster is less than 10,000 light years, which makes this cluster over 100 light years across .

M55 is another large globular cluster. It has a looser structure than M22. Estimated distance to this cluster is 20,000 light years, which makes this cluster over 80 light years across.



Above: Small Sagittarius Star Cloud, center; dark nebula B93, center left; B92, center; and galactic star cluster NGC 6603, a small feature in the star cloud, photographed by Lee C. Coombs on 8 August 1999 using a 70mm F/6.4 TeleView Pronto with .8x reducer/field flattener for F/5.1. Exposure was 30 minutes on Kodak hypersensitized 2415 film developed in D-19 for 7 minutes at 20°C.

Objects for Astrophotography in Sagittarius

	Mag.	Size.	R.A.	Declination	Description
NGC 6439	13	5" dia	17 hr 45.4 min	-16 deg 28 min	Planetary nebula with 18th mag. central star.
NGC 6440	10	60" dia	17 hr 45.9 min	-20 deg 21 min	Globular star cluster.
NGC 6445	13	35" x 30"	17 hr 46.3 min	-20 deg 20 min	Planetary nebula with 19th mag. central star
NGC 6469		12' dia	17 hr 49.9 min	-22 deg 20 min	Galactic cluster with about 40 stars.
NGC 6494	7	25' dia	17 hr 54.0 min	-19 deg 01 min	M23, galactic cluster with about 100 stars.
NGC 6514		25' dia	17 hr 58.9 min	-23 deg 02 min	M20, Trifid Nebula, diffuse nebula.
B 86		4.5' x 3'	18 hr 00.0 min	-27 deg 50 min	Dark nebula.
NGC 6520	9	5' dia	18 hr 00.3 min	-27 deg 54 min	Galactic cluster with about 25 stars.
NGC 6522	10.5	2' dia	18 hr 00.4 min	-30 deg 02 min	Globular star cluster.
NGC 6523	5	40' x 80'	18 hr 01.6 min	-24 deg 20 min	M8, the Lagoon Nebula, diffuse nebula.
NGC 6530		10' dia	18 hr 01.6 min	-24 deg 20 min	Galactic cluster with about 25 stars.
NGC 6528	11	1' dia	18 hr 01.6 min	-30 deg 04 min	Globular star cluster.
NGC 6531	7	10' dia	18 hr 01.8 min	-22 deg 30 min	M21, galactic star cluster with about 50 stars.
NGC 6537	12	5" dia	18 hr 02.2 min	-19 deg 51 min	Planetary nebula, almost stellar.
NGC 6540		1' dia	18 hr 03.1 min	-27 deg 50 min	Galactic star cluster with about 12 stars.
NGC 6544	9	1' dia	18 hr 04.2 min	-25 deg 01 min	Globular star cluster.
NGC 6546	11	13' dia	18 hr 04.2 min	-23 deg 19 min	Galactic star cluster.
I 4681	9	8' dia	18 hr 05.2 min	-23 deg 27 min	Diffuse nebula, part of NGC 6559.
NGC 6553	10	2' dia	18 hr 06.3 min	-25 deg 56 min	Globular star cluster.
NGC 6559	10	5' dia	18 hr 00.8 min	-24 deg 08 min	Diffuse nebula, connected with I.4681.
NGC 6558	10	2' dia	18 hr 07.0 min	-31 deg 46 min	Compact star cluster, may be galactic.
NGC 6565	13	10" x 8"	18 hr 08.7 min	-28 deg 11 min	Planetary nebula, almost stellar.
NGC 6563	13	50" x 35"	18 hr 08.8 min	-33 deg 53 min	Planetary nebula with 18th mag. central star
NGC 6568	11	15' dia	18 hr 09.8 min	-21 deg 26 min	Galactic star cluster with about 30 stars.
NGC 6569	10	2' dia	18 hr 10.4 min	-21 deg 36 min	Globular star cluster.
NGC 6567	11.5	11" x 7"	18 hr 10.8 min	-19 deg 05 min	Planetary nebula with 13th mag. central star.
NGC 6578	13.5	8" dia	18 hr 11.9 min	-20 deg 18 min	Planetary nebula with 16th mag. central star.
B 92		15' dia	18 hr 12.7 min	-18 deg 20 min	Dark nebula.
NGC 6583	12	2' dia	18 hr 12.8 min	-22 deg 09 min	Galactic star cluster with about 35 stars.
NGC 6603		4' dia	18 hr 15.5 min	-18 deg 27 min	Galactic star cluster with about 50 stars.
NGC 6613	8	7' dia	18 hr 17.0 min	-17 deg 09 min	M18, galactic star cluster with about 12 stars.
NGC 6618	6	45' x 35'	18 hr 18.0 min	-16 deg 12 min	M17, the Swan Nebula, diffuse nebula.
NGC 6620	14	5" dia	18 hr 18.7 min	-26 deg 52 min	Planetary nebula with 16th mag. central star.
NGC 6624	8.5	3' dia	18 hr 20.5 min	-30 deg 23 min	Globular star cluster.
NGC 6626	8	6' dia	18 hr 21.5 min	-24 deg 54 min	M28, globular star cluster.
NGC 6629	10.5	15" dia	18 hr 22.7 min	-23 deg 14 min	Planetary nebula with 13.5th mag. central star.

NGC 6638	9.5	2' dia	18 hr	27.9 min	-25 deg 32 min	Globular star cluster.
NGC 6637	7.5	4' dia	18 hr	28.1 min	-32 deg 23 min	M69, globular star cluster.
M 25	6	35' dia	18 hr	28.8 min	-19 deg 17 min	Galactic star cluster with about 50 stars.
NGC 6642	8	2' dia	18 hr	28.8 min	-23 deg 31 min	Globular star cluster.
NGC 6644	12	2" dia	18 hr	29.5 min	-25 deg 11 min	Planetary nebula, almost stellar.
NGC 6645	9	10' dia	18 hr	29.8 min	-16 deg 56 min	Galactic star cluster with about 75 stars.
I 4732	137	2" dia	18 hr	30.9 min	-22 deg 42 min	Planetary nebula, almost stellar.
NGC 6652	8.5	2' dia	18 hr	32.5 min	-33 deg 02 min	Globular star cluster.
NGC 6656	6	18' dia	18 hr	33.3 min	-23 deg 58 min	M22, globular star cluster.
NGC 6681	8	4' dia	18 hr	40.0 min	-32 deg 21 min	M70, globular star cluster.
I 4776	12.5	8" x 6"	18 hr	42.6 min	-33 deg 23 min	Planetary nebula with 18th mag. central star.
NGC 6715	9	6' dia	18 hr	52.0 min	-30 deg 32 min	M54, globular star cluster.
NGC 6723	6	6' dia	18 hr	56.2 min	-36 deg 42 min	Globular star cluster.
NGC 6774	12.0	25' dia	19 hr	13.9 min	-16 deg 21 min	Galactic star cluster, very scattered.
NGC 6809	7	15' dia	19 hr	36.9 min	-31 deg 03 min	M55, globular star cluster.
NGC 6818	10	22" x 15"	19 hr	41.1 min	-14 deg 17 min	Planetary nebula with greenish disk and 15th mag. central star.
NGC 6822	11	20' x 10'	19 hr	42.1 min	-14 deg 53 min	Irregular galaxy, member of Local Group.
NGC 6835	13.0	2.0' x 0.3'	19 hr	51.8 min	-12 deg 42 min	Elliptical galaxy, type E8.
NGC 6864	8	3' dia	20 hr	03.2 min	-22 deg 04 min	M75, globular star cluster.
NGC 6878	13.1	1.2' x 0.9'	20 hr	10.3 min	-44 deg 41 min	Spiral galaxy, type Sb.
NGC 6990	12.7	1.2' x 1.0'	20 hr	14.8 min	-44 deg 58 min	Elliptical galaxy, type E2.
NGC 6902	12.4	0.9' x 0.7'	20 hr	21.2 min	-43 deg 50 min	Spiral galaxy, type SBa.



Above: Globular star cluster NGC 6603 photographed by Lee C. Coombs on 11 October 1978 using a 10 inch F/5 Newtonian. Exposure was 15 minutes on Kodak 103a-O film developed in MWP-2 for 9 minutes at 20°C.



Above: NGC 6559 complex photographed by Martin Germano on 11 June 1991 using an 8 inch Newtonian at F/5 with coma corrector. Exposure was 90 minutes on Kodak hypersensitized 2415 film developed in D-19 for 6.5 minutes at 68°F.



Above: Globular star cluster M52 and diffuse nebula NGC 7635 photographed by Lee C. Coombs on 22 August 2000 using a 10 inch F/5 Newtonian. Exposure was 40 minutes on Kodak Ektachrome Professional 200 slide film.