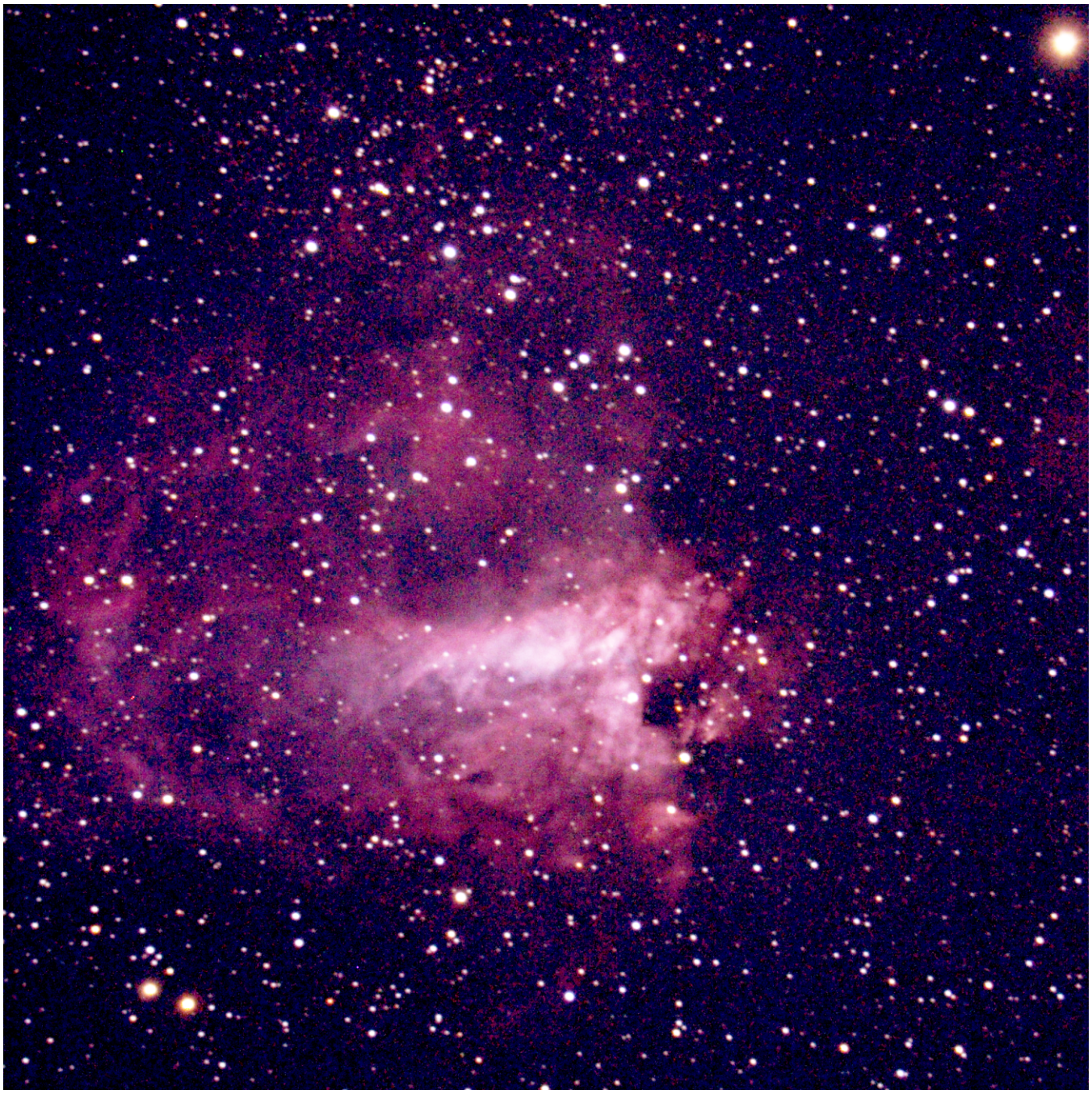
the ASTROGRAPH



Volume 38 No. 1 August/September 2006

the ASTROGRAPH

Change of Address Notices - in order to expedite your change of address please send it to us promptly and include the old mailing label from your last issue. Remember the Post Office will not forward magazines unless you guarantee forwarding postage by leaving a deposit.

Renewal Notices - Unlike other publications that hound you with renewal notices, the ASTROGRAPH is currently sending out only one renewal notice. When you renew please use the self addressed envelope, or notify us that it is a renewal. Only include a mailing label if there is no indication of your current address.

Articles and Photographs - If possible send us articles on **3.5" floppy IBM compatible disks.** Any word processor is acceptable (WordPerfect is preferred) as long as it is done on an IBM or IBM compatible computer.

COVER PHOTOGRAPH

Object.....M17, the Swan Nebula

Photographer.....Robert C. Price

Instrument.....8 inch SCT at F/6.3 with reducer/corrector

Exposure/Camera.....264 seconds/Canon 350D at 400ASA

Date.....20 June 2006

Location.....Just south of Blue Knob State Park in Pennsylvania

VOLUME 38 No. 1
EDITOR.....Robert C. Price
CONTRIBUTING EDITOR.....Ralph Proctor
PROOFING CONTRIBUTOR.....Linda Miller
CONTRIBUTORS.....Lee C. Coombs
Dr. Eugene Wells

Features

Departments

The ASTROGRAPH is published in Adobe PDF format six times a year as follows: No. 1, August/March, No. 2 December/March, No. 3 December/March, No. 4 February/March, No. 5 April/May, No. 6 June/July.

Download subscription rate is **$3.00 per year**. **Mailed CD** subscription rate is **$15.00** per year for the United States or any address with a U.S. zip code. Mailed CD subscription rate for Canada is $20.00 per year. Mailed CD subscription rate for Mexico is $30.00 per year. Mailed CD subscription rate for all other foreign countries is $35.00 per year. Subscriptions and all manuscripts and photographs submitted for editorial consideration should be sent to **the ASTROGRAPH, Post Office Box 369, Dumfries, VA 22026**. NOTE: for persons submitting articles please indicate if you do not want your name and address to appear at the conclusion of the article. Photographs are kept on file for possible use as illustrations at a later date unless accompanied by a self addressed envelope with return postage. AIRMAIL CD subscription rates per year: U.S. $22.00, Canada and Mexico $31.00, all other foreign countries $35.00.

ASTROPHOTOGRAPHY PRODUCT SURVEY

by

Robert C. Price

The last product survey was published in the April/May 2005 issue. As with past surveys this survey is a summary of astrophotography related equipment that has been advertised in the last 12 months in the publications Sky and Telescope and Astronomy. It is intended to help ASTROGRAPH readers locate equipment and suppliers that meet their astrophotographic needs. Although prices have remained fairly constant for most items, one product, the CCD, which has been expected to fall in cost for years, still has not. CCDs still seem to be increasing in both cost and capabilities. By comparison, in the last year, several "low cost" digital SLR cameras have been introduced with pixel arrays of over 8 megapixels.

ASTROPHOTOGRAPHY PRODUCT SURVEY

MANUFACTURER	PRODUCT	COST
CAMERA PRODUCTS		
Adorama	Canon 20Da DSLR	$2199.00
Apogee Inc	Piggy-back camera mount	$14.95
Celestron	Focal reducer/Field corrector F/6.3	$139.00
Lumicon	Camera T-rings	$19.95
	Deluxe piggyback adjustable (6"-14") camera mount	$59.50
	Camera adapter prime focus .965 inch	$19.95
	Camera adapter prime focus 1.25 inch	$24.95
	Camera adapter prime focus 2 inch	$49.95
	Camera adapter eyepiece projection .965 inch	$39.95
	Camera adapter eyepiece projection 1.25 inch	$39.95
	Camera adapter T-thread	$29.95
Meade	Series 4000 F/6.3 focal reducer/field flattener	$129.95
	Series 4000 F/3.3 focal reducer/field flattener	$149.95
	#644 1.25 inch flip-mirror system	$149.95
	#647 2 inch flip-mirror system	$249.95
Scopetronix	MaxView digital camera eyepiece projection adapter 1.25 inch	$129.00
	MaxView digital camera eyepiece projection adapter 2 inch	$189.00
	Digi-T digital camera adapter	$119.95
Woodland Hills Telescope	Canon 20Da DSLR	$2195.00
FILM PRODUCTS/SERVICES		
Lumicon	Model 300 hypersensitizing kit	$375.95
	Model 600 hypersensitizing kit	$475.95
	Model 1200 hypersensitizing kit	$751.95

OFF AXIS GUIDERS

Astrodon	Off-axis guider for CCD imaging	$-unk
Celestron	Celestron radial guider	$124.00
Lumicon	Newtonian Easy-Guider (1.25 or 2 inch)	$189.95
	Cassegrain Easy-Guider F/6.5 for 5 - 9.25 inch SCT	$249.95
	Giant Easy-Guider F/6.5 (C11,C14, and 10-16" Meade)	$399.95
Taurus Technologies	Taurus Tracker III off-axis guider	$394.00

FILM (35mm unless otherwise specified)

Lumicon	Hypersensitized Fuji G 800 24exp	$19.95
	Hypersensitized Kodak 2415 36exp	$19.95
	Hypersensitized Kodak 2415 #120	$19.95
	Hypersensitized Fuji RD100	$14.95
	Hypersensitized Kodak P1600	$24.95

FILTERS

Astronomics	Tele Vue UHC filter 1.25 inch	$95.00
	Tele Vue UHC filter 2 inch	$185.00
	Tele Vue Oxygen III filter 1.25 inch	$95.00
	Tele Vue Oxygen III 2 inch	$185.00
Celestron	Oxygen III filter 1.25 inch	$69.00
	Oxygen III filter 2 inch	$99.00
	Minus Violet filter 1.25 inch	$49.00
	UHC/LPR filter 1.25 inch	$69.00
	UHC/LPR filter 2 inch	$99.00
	UV/IR cutoff filter 1.25 inch	$59.00
Lumicon	UHC (Ultra High Contrast) filter 1.25 inch	$99.95
	UHC (Ultra High Contrast) 48mm or 2 inch dia.	$199.95
	Deep Sky 1.25 inch	$99.95
	Deep Sky 48mm or 2 inch T-threaded	$199.95
	H-alpha pass 1.25 inch	$79.95
	H-alpha pass 48mm	$69.95
	H-alpha pass 58mm	$79.95
	H-alpha pass 77mm	$89.95
	H-alpha pass 82mm	$99.95
	Hydrogen beta, 1.25 inch	$99.95
	Hydrogen beta, 48mm and 2 inch	$199.95
	Oxygen III 1.25 inch	$99.95
	Oxygen III 48mm and 2 inch	$199.95
	Minus violet 48mm	$79.95
	Minus violet 58mm	$89.95

	Minus violet 72mm	$99.95
	Comet band filter 1.25 inch	$99.95
	Comet band filter 48mm and 2 inch	$199.95
Meade	Series 4000 nebula broadband 1.25 inch #908B	$79.95
	Series 4000 nebula broadband 36mm for SCT #911B	$99.95
	Series 4000 nebula narrowband 1.25 inch #908N	$89.95
	Series 4000 nebula narrowband 36mm for SCT #911N	$119.95
	Series 4000 Oxygen III, 1.25 inch #908x	$99.95
	Series 4000 Oxygen III, 36mm for SCT #911x	$149.95

CCD CAMERAS

Anacortes Telescope and Wild Bird	Yankee Robotics Trifid-2 CCD camera	$5125
Astronomics	ST 402XME	$1290.00
	SBIG ST-7XME	$1995.00
	SAC7B	$499.00
Astrodon	CCD	$-unk
Celestron	Neximage	$99.99
Finder Lakes Instrumentation	Cooled CCD camera	$1495 to $40,000
Meade	DSI deepsky imager	$299.00
	DSI II pro with filters	$699.00
	Lunar planetary imager	$99.00
Orion	Deep Space CCD color imager	$399.95
	Star Shot solar system color imager	$99.00
SAC Imaging	SAC 8 CCD	$549.00
	SAC 10 CCD, 3.3 megapixel	$900.00
SBIG	ST-402ME	$-unk
	ST-7XME	$-unk
	ST-8XME	$-unk
	ST-9XE	$-unk
	ST-10XME	$-unk
	ST-2000XM	$-unk
	ST-2000XCM	$-unk
	STL-1001E	$-unk
	STL-1301E	$-unk
	STL-4020CM	$-unk
	STL-6303E	$-unk
	STL-11000M	$-unk
	STL-11000CM	$-unk
Starlight Express Ltd	SXV-M25C	$-unk
	SXV-M8C	$-unk

ILLUMINATED RETICLE GUIDING EYEPIECES

Lumicon	25mm Kellner crosshair	$69.95
	12.5mm Orthoscopic wireless 1.25 inch	$149.95

	Pulse guide illuminator	$42.95
Meade	MA 35mm Plossl1.25 inch cordless	$129.95
	MA 12mm 1.25 inch cordless	$99.95
	Series 4000 Plossl 9mm wireless 1.25 inch	$149.95
Rigel Systems	Pulse Guide 12.5mm Plossl reticle 1.25 inch	$119.95

BOOKS/SOFTWARE

William-Bell	The Handbook of Astronomical Image Processing by Richard Berry and James Burnell	$99.95
	Photoshop Astronomy by R Scott Ireland	$39.95

SOLAR FILTERS

Coronado	Solar Max 40	$1450
	Solar Max 60	$2590
	Solar Max 90	$5045
Lumicon	Solar prominence filter 1.5 angstrom, 7 and 8 inch SCT.	$779.95
	Solar prominence filter 1.5 angstrom, 10 inch Meade.	$789.95
	Solar prominence filter 1.5 angstrom, C11	$799.95
	Solar prominence filter 1.5 angstrom, 12 inch Meade	$809.95
	Solar prominence filter 1.5 angstrom, C14.	$819.95
	Solar prominence filter 1.5 angstrom, 14 inch Meade	$819.95
	Solar prominence filter 1.5 angstrom, 16 inch Meade.	$899.95

EQUATORIAL MOUNTS

Anacortes Telescope and Wild Bird	Paramount ME	$-unk
	Lasmandy GM11	$-unk
Apogee	HD equatorial mount	$169.95
Astro-Physics	900GTO equatorial mount	$-unk
Astronomics	Celestron CG5	$399.00
	Celestron CGE	$3000
	Paramount ME	$12,500
	Losmandy Titan	$5995.00
	Losmandy GM8	$1449.00
	Losmandy GM11	$2079.00
Optical-Craft Machining	Equatorial mount and drive 1 - 4.5 inch dia. steel shaft	$300-12,000
	6.6 inch diameter drive	$495.00
	9.0 inch diameter drive	$585.00
Sultan Camera and Video	Vixen Great Polaris equatorial mount	$-unk
Vixen North America	GP-D2 equatorial mount	$-unk
	Sphinx equatorial mount up to 22lb payload	$1825.00
Woodland Hills Camera	Losmandy Gemini G-8	$-unk
	Losmandy Gemini G-11	$-unk

LISTING OF MANUFACTURERS

NAME	ADDRESS	PHONE #
Adorama www.adoramacamera.com	42 W. 18th St, New York NY 10011	(800) 223-2500
Anacortes Telescopes and Wild Bird www.buytelescopes.com	unk	(800) 850-2007
Apogee Instruments Inc. www.ccd.com	1020 Sundona Way Ste 150, Roseville CA 95661	(916) 218-7450
Astronomics www.astronomics.com	680 SW 24th Ave., Norman OK 73069	(800) 422-7876
Astrodon www.astrodon.com	unk	unk
Astro-Physics www.astro-physics.com	11250 Forest Hills Rd, Rockford IL 61115	(815) 282-1513
Celestron International www.celestron.com	2835 Columbia Street, Torrance CA 90503	(800) 421-1526
Colorado www.coronadofilters.com	unk	(866) 786-9282
Finger Lakes Instrumantation www.fli-cam.com	unk	(585) 624-3760
Lumicon www.lumicon.com	2111 Research Dr, Livermore CA 94550	(415) 447-9570
Meade Instruments Corp. www.meade.com	1675 Toronto Way, Costa Mesa CA 92626	(714) 556-2291
Orion Telescope Center www.telescope.com	421 Soquel Ave Box 1150, Santa Cruz CA 95061	(800) 447-1001
Optical-Craft Machining www.opticcraft.com	33918 Macomb, Farmington MI 48335	(248) 476-5893
Regel Systems www.regelsys.com	unk	(310) 375-4149
SAC Imaging www.sac-imaging.com	PO box 360982, Melbourne FL 32935	(321) 259-6498
SBIG www.sbig.com	147-A Castilian Dr, Santa Barbara CA 93117	(805) 571-7244
Scopetronix www.scopetronic.com	1423 SE 10th Street, Cape Coral FL 33990	(941) 945-6763
Shutan Camera and Video www.shutan.com	312 W. Randolph, Chicago IL 60606	(800) 621-2248
Starlight Express Ltd. www.astrovid.com	unk	(877) 348-8433
Taurus Technologies www.taurus-tech.com	PO Box 14, Woodstown NJ 08098	(609) 769-4509
Vixen North America www.vixennamerica.com	32 Erkay Dr., Chester NY 10918	(845) 469-8680
Willmann-Bell Inc www.willbell.com	PO Box 35025, Richmond VA 23235	(800) 825-7827
Woodland Hills Camera www.whtelescopes.com	5348 Topanga Cyn Blvd, Woodland Hills CA 91364	(818) 347-2270

Above: M84 and M86 photographed by Lee C. Coombs on 14 April 2004 using a 10 inch F/5 Newtonian. Exposure was 35 minutes on Ektachrome 200 professional film.

Above: M92 photographed by Lee C. Coombs on 30 May 2003 using a 10 inch F/5 Newtonian. Exposure was 35 minutes on Ektachrome 200 professional film.

Astrophotography for August and September

by

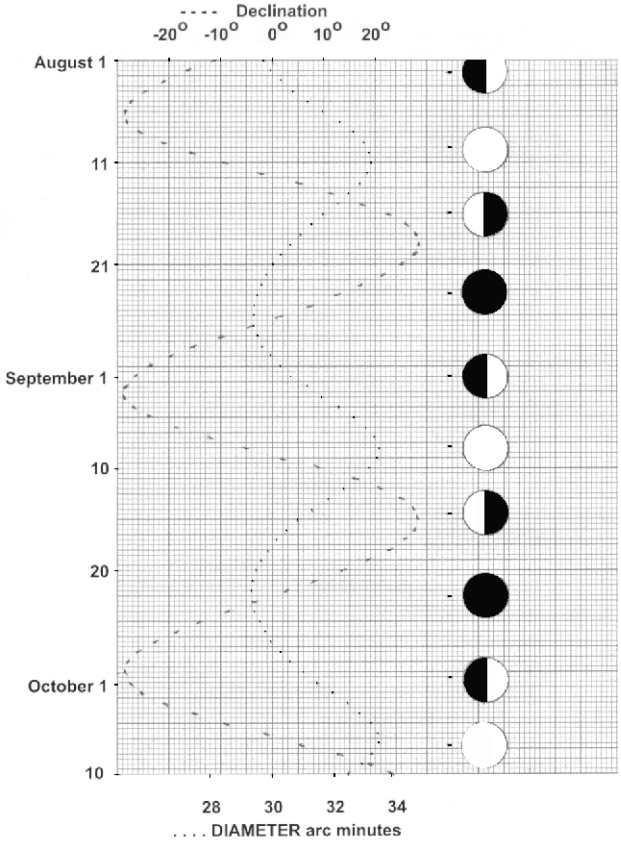
Ralph Proctor

Mercury begins August as a morning object low in the eastern sky. Mercury reaches a greatest western elongation of 19 degrees on 7 August when it will be in good photographic position with a declination of plus 19 degrees. During the remainder of August Mercury moves lower in the eastern sky and disappears into the Sun's glare in late August, reaching superior conjunction on 1 September. Mercury emerges from the Sun's glare in late September as an evening object low in the western sky.

Venus begins August as a morning object low in the eastern sky. During August Venus moves lower in the eastern sky and disappears into the Sun's glare in early September.

The Moon's waning crescent and quarter phases will be located high on the ecliptic and in excellent photographic position during August (August 19) and September (September 16), with an apparent declination of up to +28 degrees.

Lunar Declination and Diameter:



Mars begins August as an evening object low in the western sky in the constellation Virgo. During August Mars moves lower in the western sky and disappears into the Sun's glare in early September. During August and September Mars increases in brightness from magnitude + 1.8 to + 1.7, and decreases in diameter from 3.8 to 3.6 arc seconds.

Jupiter begins August as an evening object high in the western sky in the constellation Libra. During August and September Jupiter moves lower in the western sky, decreases in brightness from magnitude -2.1 to -1.8, and decreases in diameter from 37.3 to 32.3 arc seconds.

Saturn begins August lost in the Sun's glare. Saturn emerges from the Sun's glare in late August as a morning object low in the eastern sky in the constellation Cancer, but moves into the constellation Leo in early September. During August and September Saturn decreases in brightness from magnitude +0.3 to + 0.5, and increases in diameter from 16.37 to 16.9 arc seconds.

Uranus begins August as a morning object high in the eastern sky in the constellation Aquarius. During August and September Uranus moves higher in the eastern sky and reaches opposition on 5 September. During August and September Uranus increases in brightness from magnitude + 5.8 to + 5.7, and increases in diameter from 3.66 to 3.68 arc seconds. Uranus is located at R.A. 23 hours 00.7 minutes declination -7 degrees 12 minutes on 15 August and at R.A. 22 hours 56.2 minutes declination -7 degrees 40 minutes on 15 September.

Neptune begins August as a morning object high in the eastern sky in the constellation Capricornus and reaches opposition on 11 August. During the remainder of August and September Neptune moves lower in the western sky, remains constant in brightness at magnitude +7.8, and decreases in diameter from 2.35 to 2.32 arc seconds. Neptune is located at R.A. 21 hours 23.2 minutes declination -15 degrees 32 minutes on 15 August and at R.A. 21 hours 20.2 minutes declination -15 degrees 47 minutes on 15 September.

Pluto begins August as an evening object high in the western sky. During August and September Pluto moves lower in the western sky and remains constant in brightness at magnitude + 13.9. Pluto is located at R.A. 17 hours 35.8 minutes declination

-15 degrees 53 minutes on 15 August and at R.A. 17 hours 35.3 minutes declination -16 degrees 02 minutes on 15 September

Events:

Uranus will be occulted by the Moon on 11 August (06 hours Universal Time) for all but the northwest part and southern tip of South America, and western Africa; and on 7 September (15 hours Universal Time) for most of Australia and part of New Guinea.

Spica will be occulted by the Moon on 1 August (01 hours Universal Time) for the southern portion of South America; on 28 August (08 hours Universal Time) for Madagascar and southern New Zealand; and on 24 September (14 hours Universal Time) for all but the southern portion of South America.

Antares will be occulted by the Moon on 4 August (18 hours Universal Time) for the extreme northeastern portion of South America and the tip of South Africa; on 1 September (02 hours Universal Time) for the extreme eastern portion of Australia, New Zealand, and the area south of South America; and on 28 September (08 hours Universal Time) for the extreme eastern position of Africa and New Zealand.

Mars will be occulted by the Moon on 25 September (14 hours Universal Time) for the central and northeastern portion of South America.

The Sun will undergo an annular eclipse on 22 September 2006. The eclipse starts in northeastern South America, crosses the Atlantic, continues between Africa and Antarctica, and ends in the ocean southeast of southern Africa. The eclipse begins and ends at 8 hours 39.9 minutes and 14 hours 40.2 minutes Universal Time respectively. Central eclipse at local apparent noon occurs at 12 hours 07.1 minutes Universal Time.

The Moon will undergo a partial eclipse on 7 September 2006 for Antarctica, Australasia, Asia, Africa, Europe, and the British Isles. The eclipse begins (umbra contact) at 18 hours 01.5 minutes and ends at 19 hours 37.6 minutes Universal Time. Mid-eclipse occurs at 18 hours 51.3 minutes Universal Time. Only a small portion of the Moon is eclipsed by the umbra.

MINOR PLANETS

		position			
		15 August		15 September	
Planet	Magnitude	R.A.	Decl.	R.A.	Decl.
Ceres	07.7 - 08.4	21 hr 44.8 min	-28 deg 14 min	21 hr 21.5 min	-29 deg 35 min
Pallas	09.7 - 10.3	18 hr 02.8 min	+17 deg 15 min	18 hr 07.1 min	+11 deg 08 min
Juno	10.5 - 10.7	10 hr 12.4 min	+08 deg 32 min	11 hr 03.9 min	+04 deg 36 min
Vesta	08.1 - 07.9	10 hr 35.9 min	+13 deg 24 min	11 hr 32.5 min	+07 deg 53 min

Back issues of the ASTROGRAPH in its printed format are still available for $1.50 each ($2.00 for each color issue) plus postage. Currently the following issues are available:

Volume No. 6 issue 6
Volume No. 7 issue 5 and 6
Volume No. 8 issue 11, 3, 4, and 5
Volume No. 9 issue 1, 4, 5, and 6
Volume No. 10 issue 2, 3, 5, and 6
Volume No. 11 issue 1, 2, 3[1], 4, 5, and 6
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
Volume No. 18 issue 1, 4, 5, and 6
Volume No. 19 issue 1, 2, 3, 4, 5, and 6
Volume No. 20 issue 1, 2, 3[1], 4, 5, and 6
Volume No. 21 issue 1, 2, 3, 4, 5, and 6
Volume No. 22 issue 1, 2, 3, and 4
Volume No. 23 issue 4 and 5
Volume No. 24 issue 5 and 6
Volume No. 25 issue 1, 2, 4, and 6
Volume No. 26 issue 1, 2, 3, 5, and 6
Volume No. 27 issue 2, 3, 4, 5, and 6
Volume No. 28 issue 5 and 6
Volume No. 29 issue 1, 2, 3, 4, 5, and 6
Volume No. 30 issue 1, 2, 3, 4[1], 5, and 6
Volume No. 31 issue 1, 2, 3, 4, 5, and 6
Volume No. 32 issue 1, 2, 3, 4, 5, and 6
Volume No. 33 issue 1, 2, 3, 4, 5, and 6
Volume No. 34 issue 1, 2, 3, 4, 5, and 6
Volume No. 35 issue 1 and 2

NOTES: 1 - Color issue - $2.00 each
2 - Comet photography issue.

Postage (foreign and domestic) - Add $1.07 for the first issue and $0.75 for each additional issue.

MAILING ADDRESS:
the ASTROGRAPH
PO Box 369 Phone#
Dumfries, VA 22026 (703) 441-6778

Product Evaluation: Nikon D2X and D100

by
Robert C. Price

On 21 June 2006 Dr. Eugene Wells and I were able to take 5 long astronomical exposures centered on M20 using a Canon 350D, a Nikon D100, and a Nikon D2X. These exposures were taken from Dr. Well's farm located near Blue Knob State Park in Pennsylvania. This location provides a dark sky and a good view of the southern sky. This camera comparison was not ideal because the 300mm F/2.8 Tamron lens used by the two Nikons was adapted to the dovetail plate at the last minute and did not have sufficient clearance to be aligned with the guide scope. As a result the guide scope could not be used and had to be unmounted. Thus all exposures were unguided. The cameras being evaluated are all digital SLR cameras. The Canon 350D and Nikon D100 are consumer oriented digital cameras currently costing less than $1000, while the Nikon D2X is a more professional camera costing about $4300. A specific camera comparison is as follows:

The Canon 350D:

Specified size: 8.2 megapixel
Image size: 3456 by 2304 pixels
Image sensor: 22.2 by 14.8mm CMOS
Camera body weight: 17.1 oz.
Camera body size: 3.7 by 5.0 by 2.7 inches
ISO range 100 to 1600
Mirror lock up: yes

The Nikon D100:

Specified size: 6.1 megapixel
Image size: 3008 by 2000 pixels
Image sensor: 23.7 by 15.6mm CCD
Camera body weight: 1.54 lbs.
Camera body size: 5.7 by 3.2 by 4.6 inches
ISO range 200 to 1600

The Nikon D2X:

Specified size: 12.4 megapixel
Image size: 4288 by 2848 pixels
Image sensor: 23.7 by 15.7mm CMOS
Camera body weight: 2.4 lbs.
Camera body size: 6.2 by 5.9 by 3.4 inches
ISO range 100 to 800
Mirror lock up: yes

The first two exposures were taken with the Canon 350D and a Canon 300mm F/4 lens at F/4. Exposures were 407 seconds and 585 seconds at 400ASA. The 407 second exposure is shown in Figure 1 on page 13. This shorter Canon 350D exposure is more of a comparison to the 307 second exposure, shown in Figure 2 on page 14, taken with a Nikon D2X at 100ASA. The image in Figure 2 was taken with a 300mm F/2.8 Tamron lens at F/2.8. The image in Figure 1 was taken at 400ASA, 4 times the sensitivity of the exposure taken with the Nikon D2X in Figure 2, which was taken at 100ASA. Negating some of this increase in ASA sensitivity is the fact that the exposure in Figure 1 was taken at F/4 while the exposure taken with the Nikon D2X in Figure 2 was taken at F/2.8, which allowed twice the amount of light to reach the imaging sensor. The last two exposures were taken with the Nikon D100 and 300mm F/2.8 Tamron lens at F/2.8. Exposures with the Nikon D100 were 359 and 296 seconds at 250ASA. Figure 3 on page 15 is the 359 second exposure with the Nikon D100. Because the D100 exposure was taken at 250ASA it is a good comparison to the Canon 350D image in Figure 1 in terms of combined sensitivity and exposure. The images in Figures 2 and 3 were cropped because the images taken with the Nikons were taken with the long axis horizontal while the Canon image was taken with the long axis vertical. The Canon 350D image in Figure 1 is a full frame image. Shown in Figure 4 on page 16 are the unprocessed images taken with the Canon 350D (top image), the Nikon D2X (middle image), and Nikon D100 (bottom image). The TIFF image file conversion from the Nikon RAW image was adjusted to ensure that all pixels were captured. The Nikon D100 image showed hundreds of large blue noise spikes, and many small hot pixels surrounded by black, giving the appearance of a black donut. The D2X showed a few hundred small blue and red noise spikes. The Canon 350D showed much less noise than either Nikon, about 10 blue and red noise spikes and a few green hot pixels.

Above: Figure 1. M20 and M8 taken by the author from a location near Blue Knob State Park, PA. on 21 June 2006 with a Canon 300mm F/4 EF lens at F/4. Unguided exposure was 407 seconds with a Canon 350D at 400ASA.

Above: Figure 2. M20 and M8 taken by the Dr. Eugene Wells and the author from a location near Blue Knob State Park, PA. on 21 June 2006 with a Tamron 300mm F/2.8 lens at F/2.8. Unguided exposure was 307 seconds with a Nikon D2X at 100ASA.

Above: Figure 3. M20 and M8 taken by the Dr. Eugene Wells and the author from a location near Blue Knob State Park, PA. on 21 June 2006 with a Tamron 300mm F/2.8 lens at F/2.8. Unguided exposure was 359 seconds with a Nikon D100 at 250ASA.

Above: Figure 4. Above: Unprocessed images seen in Figure 1 (Canon 350D, top image), Figure 2 (Nikon D2X, middle image) and Figure 3 (Nikon D100, bottom image).