the ASTROGRAPH



Volume 35 No. 4 **February/March 2004**

the ASTROGRAPH

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COVER PHOTOGRAPH

Object.....M100

Photographer.....Chuck Vaughn

Instrument.....12.5 inch F/9 Ritchey-Chretien

Film/Exposure.....Hypersensitized Kodak 2415 film/90 minutes

VOLUME 35 No. 4

EDITOR.....Robert C. Price
CONTRIBUTING EDITOR.....Ralph Proctor
PROOFING CONTRIBUTOR.....Linda Miller
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ASTROPHOTOGRAPHY PRODUCT SURVEY

by

Robert C. Price

The last product survey was published in the February/March 2003 issue. As with past surveys this survey is a summary of astrophotography related equipment that has been advertized in the last 12 months in *Sky and Telescope* and *Astronomy* magazine. 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 was expected to fall in cost, still has not. CCDs still seem to be increasing in both cost and capabilities. By comparison, in the last year, digital camera costs have been reduced by about half for the same capability.

ASTROPHOTOGRAPHY PRODUCT SURVEY

MANUFACTURER	PRODUCT	COST
CAMERA PRODUCTS		
Adorama	Dig-T digital camera adapter	$24.95
	Celestron tele-extender deluxe	$48.95
	Slow motion control	$29.95
	Universal 1.25" T-adapter	$24.95
	T-C 16mm adapter	$26.95
Apogee, Inc.	1.25 inch camera adapter w/built-in flip mirror	$59.95
Celestron	F/6.3 reducer/corrector	$139.00
Focus Camera and Video	T-adapter for SCTs	$24.95
	Meade basic tele-extender	$29.95
	Celestron piggyback mount for 8 inch SCT	$34.95
Lumicon	Comma corrector	$199.50
	48mm reducer/corrector	$199.50
	Deluxe piggyback adjustable camera mount	$59.50
Meade	Series 4000 F/6.3 focal reducer/field flattener	$149.95
	Series 4000 F/3.3 focal reducer/field flattener	$149.95
	Camera adapter .965 inch	$27.95
	Camera adapter 1.25 inch	$29.95
	Variable-projection camera adapter 1.25 inch	$39.95
	Variable tele-extender	$39.95
	T-adapter for SCT	$26.95
	#644 1.25 inch flip-mirror system	$149.95
	#644 2 inch flip-mirror system	$249.95
Scopetronix	T-ring adapter 1.25 inch	$49.95
	Digital camera adapter	$49.95
	WebCam adapter	$22.95-29.95
	Digi-T digital camera adapter	$59.95-109.95
Sultan Camera and Video	35mm Astro SLR	$220.00
Taurus Technologies	Hyper camera - 35mm film (self hypering)	$229.00
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

Celestron	Radial guider	$124.00
Lumicon	Newtonian Easy-Guider (1.25 or 2 inch)	$189.95
	Cassegrain Easy-Guider F/6.2 for 8 inch SCT	$249.95
	Giant Easy-Guider (Celestron C11,C14, and 10" Meade)	$399.95
	Newtonian Easy-Guider focal reducer in cell	$79.95
	Comma corrector for Newtonian Easy Guider	$239.95
Meade	Off-axis guider for SCTs	$79.95
Taurus Technologies	Taurus tracker III off-axis guider	$374.00

FILM (35mm unless otherwise specified)

Lumicon	Hypersensitized Kodak PPF-400 36exp	$19.95
	Hypersensitized Kodak PPF-400 #120	$19.95
	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

Adorama	Siris MV1 minus violet filter 1.25 inch	$74.95
	Siris MV1 minus violet filter 2 inch	$119.50
	Neb1 nebula filter 1.25 inch	$74.95
	Neb1 nebula filter 2 inch	$119.50
	PC1 planetary contrast filter 1.25 inch	$74.95
	PC1 planetary contrast filter 2 inch	$119.50
	CE1 contrast enhancement filter 1.25 inch	$74.95
	CE1 contrast enhancement filter 2 inch	$119.50
Andover Corporation	Nebula filter	$-unk
	O-III filter	$-unk
Celestron	Contrast boost filter 1.25 inch	$49.00
	Light polution reduction 1.25 inch	$69.00
	Light polution reduction model B	$89.00
Lumicon	UHC filter 1.25 inch	$99.95
	UHC 48mm or 2 inch dia.	$199.95
	Deep Sky .965 inch	$89.95
	Deep Sky 1.25 inch	$99.95
	Deep Sky 48mm or 2 inch T-threaded	$199.95
	Deep Sky 72mm	$399.95
	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, 2 inch	$199.95
	Hydrogen beta, 48mm	$199.95
	Oxygen III 1.25 inch	$99.95
	Oxygen III 48mm	$199.95
	Minus violet 48mm	$49.95

	Minus violet 58mm	$59.95
	Minus violet 72mm	$69.95
	Comet band filter 1.25 inch	$99.95
	Comet band filter 48mm	$199.95
	Infrared blocking filter 2 inch	$99.95
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
Orion Telescope Center	V-block filter 1.25 inch	$69.95
	V-block filter 2 inch	$89.95
Thousand Oaks Optical	LP-1 (nebula broadband) 1.25 inch	$89.00
	LP-1(nebula broadband) 2 inch	$179.00
	LP-2 (narrowband) 1.25 inch	$89.00
	LP-2 (narrowband) 2 inch	$179.00
	LP-3 (Oxygen III) 1.25 inch	$89.00
	LP-3 (Oxygen III) 2 inch	$179.00
	LP-4 (hydrogen beta) 1.25 inch	$89.00
	LP-4 (hydrogen beta) 2 inch	$179.00
Williams Optics Co.	VR-1 filter	$-unk

CCD CAMERAS

Adirondack Video Astron.	SXV-H9	$-unk
	MX5c/Mx7c	$-unk
	ST10XME	$-unk
	ST2000XM	$-unk
	STV delux	$-unk
Astronomics	SBIG ST-2000XM	$3495.00
	SBIG ST-9XE	$3695.00
	SBIG ST-10XME	$6995.00
	SAC7B	$499.00
Focus Camera and Video	Pictor 201-XT autoguider/imager	$395.00
	Pictor 208-XT autoguider/imager	$495.00
	Pictor 216-XT autoguider/imager	$695.00
	Pictor 616-XTE autoguider/imager	$1995.00
	Pictor 1616-XTE autoguider/imager	$6495.00
ITE Telescopes	Deep sky pro CCD video camera	$-unk
Meade	Pictor 216XT CCD and autoguider/imager	$695.00
Starlight Express Ltd	STAR 2000	$-unk
Anacortes Telescopes	ST-7XE	$2695.00
	ST-8XE	$5995.00
	ST-9XE	$3695.00
	ST-10X (M)(E)	$6995.00
	ST 2000 XM	$3495.00
Woodland Hills Camera	SBIG ST-237a	$1395.00
	SBIG ST7-E	$2395.00
	SBIG STV deluxe	$2295.00
	Meade 416 XTE	$1995.00
	Meade 216 XT	$695.00

ILLUMINATED RETICLE GUIDING EYEPIECES

Celestron	Microguide eyepiece wireless 1.25 inch	$194.00
Lumicon	12.5mm Orthoscopic wireless 1.25 inch	$149.95
	Pulse guide illuminator	$42.95
Meade	MA 12mm 1.25 inch	$79.95
	MA 12mm 1.25 inch cordless	$99.95
	Series 4000 Plossl 9mm wireless 1.25 inch	$149.95

FOCUSING AIDS

STI	Knife-edge focuser for 35mm and CCD cameras	from $179.00

BOOKS

Firefly Books	Astrophotography by Arnold	$19.95

SOLAR FILTERS

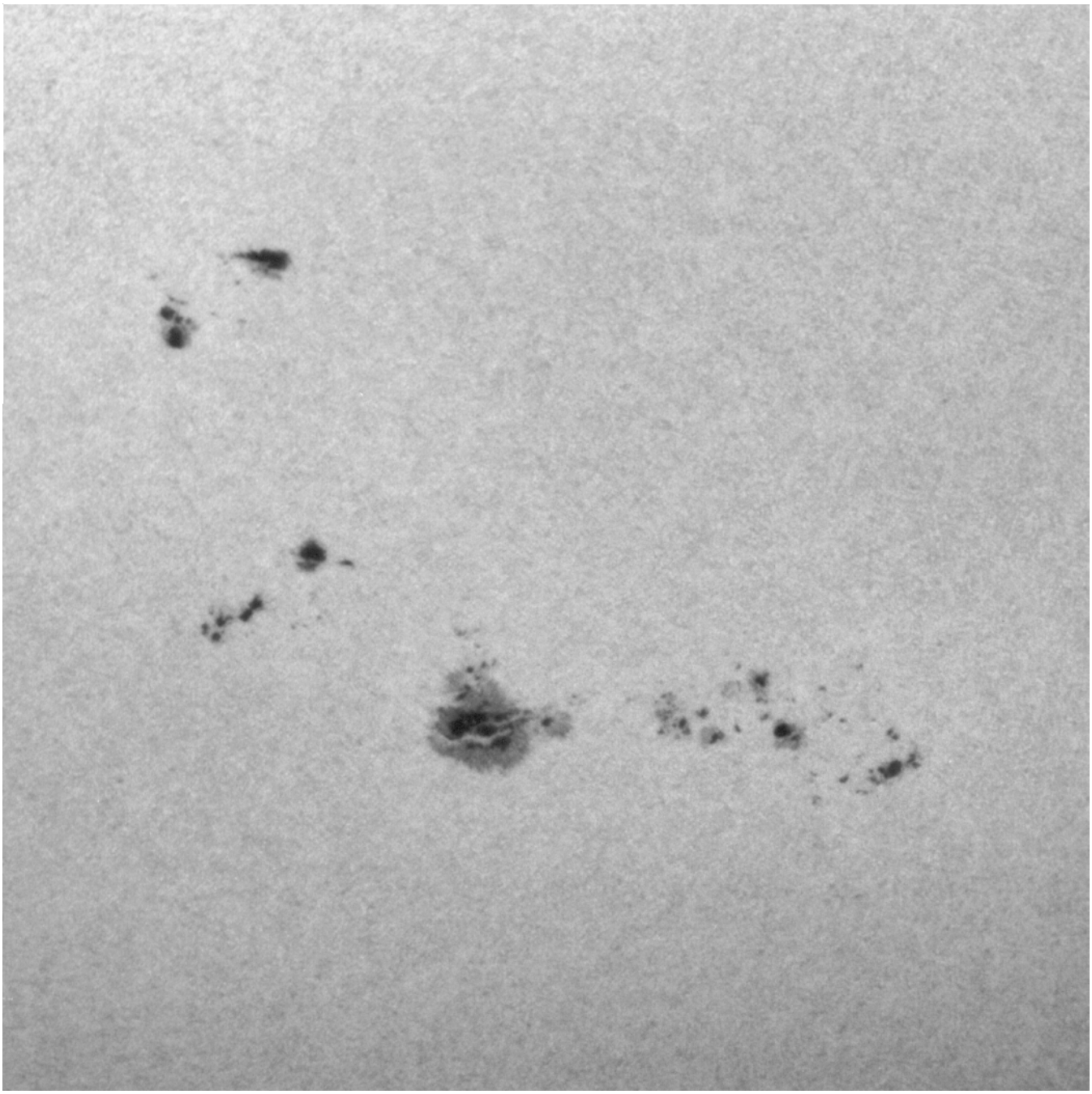
Adorama	Solar glass filter, 8 inch	$99.95
	Solar glass filter, 10 inch	$119.95
	Solar glass filter, 11 inch	$129.95
J.M.B.	Class C ND4 solar filter	$-unk
Lumicon	Solar prominence filter 1.5 angstrom, 2 inch cell	$699.95
Shutan Camera and Video	Full aperture 8 inch	$139.00
Thousand Oaks Optical	Type III glass filter ND=4 For photography 2.4 - 14 inch	$69.00-$199.00

EQUATORIAL MOUNTS

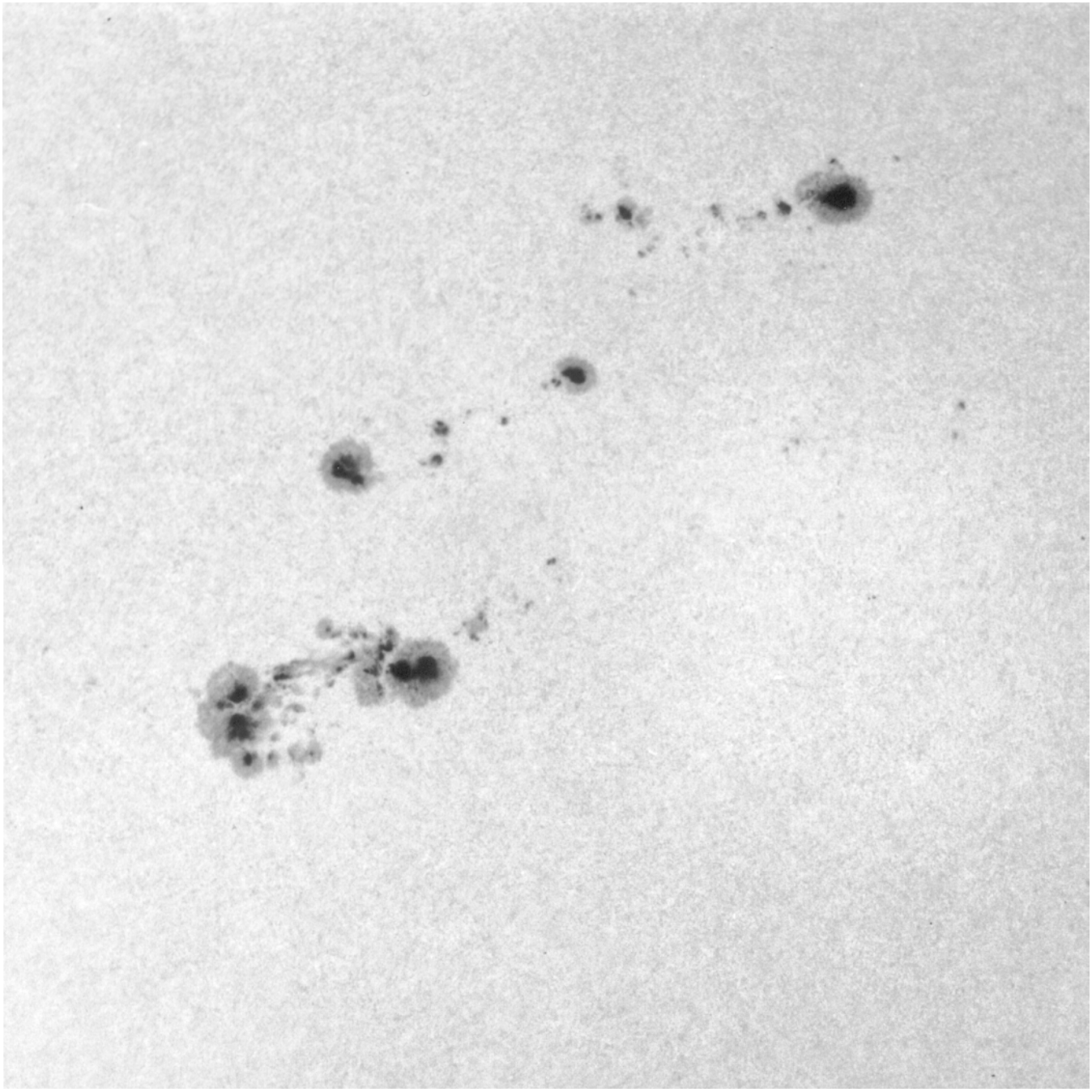
Adorama	Celestron G-5 equatorial mount	$349.95
	CG-5 computerized mount	$659.95
Apogee Inc.	H.D. equatorial mount	$159.95
Astro-Physics	900GTO German equatorial mount	$-unk
Astronomics	Losmandy GM-8	$1449.00
	Losmandy GM-11	$2079.00
	Meade Starfinder	$1995.00
	Takahashi P2Z	$2219.00
	Vixen GP	$800.00
Boston Telescope	Celestron CGE mounts	$-unk
Celestron	CG-5A	$349.00
Focus Camera and Video	Ash Gibralter mount	$595.00
	CG-3	$144.95
	CG-5	$369.95
High Point Scientific	Ash Gibraltar	$595.00
	Losmandy G-11	$1995.00
	Losmandy G-8	$1525.00
	Vixen GP DX mount	$1220.00
	Vixen GP EQ mount	$800.00
Mathis Instruments	German equatorial mount	$-unk
Optical-Craft Machining	Equatorial mount and drive 1 - 4.5 inch dia. steel shaft	$300-6,800
	6.6 inch diameter drive	$495.00
	9.0 inch diameter drive	$585.00
Orion Telescope Center	Atlas heavy duty equatorial mount w/motors	$799.00
	Sky View pro equatorial mount	$449.00
Woodland Hills Camera	Losmandy Gemini G-8	$1399.00
	Losmandy Gemini G-11	$1895.00

LISTING OF MANUFACTURERS

NAME	ADDRESS	PHONE #
Adirandack Video Astron. *www.astrovid.com*	35 Stephanic Lane, Queensbury NY 12804	(888) 799-0107
Adorama *www.adoramacamera.com*	42 W. 18th St, New York NY 10011	(800) 223-2500
Anacortes Telescopes *www.buytelescopes.com*	unk	(800) 850-2007
Andover Corporation *www.andcorp.com*	4 Commerce Dr, Salem NH 03079	(888) 893-9992
Apogee Instruments Inc. *www.agogee-ccd.com*	3340 N. Country Club Suite 103, Tucson AZ 85716	(520) 326-3600
Apogee Inc. *www.agogeeinc.com*	PO Box 136, Union IL 60180	(815) 923-1602
Astronomics *www.astronomics.com*	680 SW 24th Ave., Norman OK 73069	(800) 422-7876
Astro-Physics www.astro-physics.com	11250 Forest Hills Rd, Rockford IL 61115	(815) 282-1513
Boston Telescopes *www.bostontelescopes.com*	26 Border Street, Newon MA 02465	(800) 608-8439
Celestron International *www.celestron.com*	2835 Columbia Street, Torrance CA 90503	(800) 421-1526
Firefky Books www.fireflybooks.com	unk	unk
Focus Camera and Video *www.focuscamera.com*	4419-21 13th Ave, Brookland NY 11219	(718) 437-8899
High Point Scientific *www.highpointscientific.com*	422 Route 206 Montague NJ 07827	(800) 266-9590
ITE Telescopes *www.itetelescopes.com*	3555 Singing Pines Rd, Darby MT 59829	(406) 821-1980
J. M. B. Inc	736 Oak Glen Circle, Fall Branch TN 37656	(423) 348-8883
Lumicon *www.lumicon.com*	2111 Research Dr, Livermore CA 94550	(415) 447-9570
Mathis Instruments *www.mathis-instruments.com*	unk	(925) 838-1487
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
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
STI *www.stellar-international.com*	unk	(800) 232-9416
Taurus Technologies *www.taurus-tech.com*	PO Box 14, Woodstown NJ 08098	(609) 769-4509
Thousand Oaks Optical *www.thousandoaksoptical.com*	Box 248098, Farmington MI 48322	(313) 353-6825
Williams Optics Co. www.william-optics.com	unk	(714) 209-0388
Woodland Hills Camera *www.telescopes.net*	5348 Topanga Cyn Blvd, Woodland Hills CA 91364	(818) 347-2270



Above: Sunspots photographed by Lee C. Coombs on 6 June 2000 using a 6 inch F/12 APO refractor at F/19 with a B&L ND4 solar filter. A 3X negative lens was used to yield F/57. Exposure was 1/250 second on Kodak 2415 film developed in D-19 for 4 minutes at 20°C. Enlarged approximatelt 12 times.



Above: Sunspots photographed by Lee C. Coombs on 15 Octobert 1999 using a 6 inch F/12 APO refractor at F/19 with a solar filter. A 3X negative lens was used to yield F/57. Exposure was 1/500 second on Kodak 2415 film developed in Rodinal (1:25) for 14 minutes at 20°C. Enlarged approximatelt 12 times.

Astrophotography for February and March

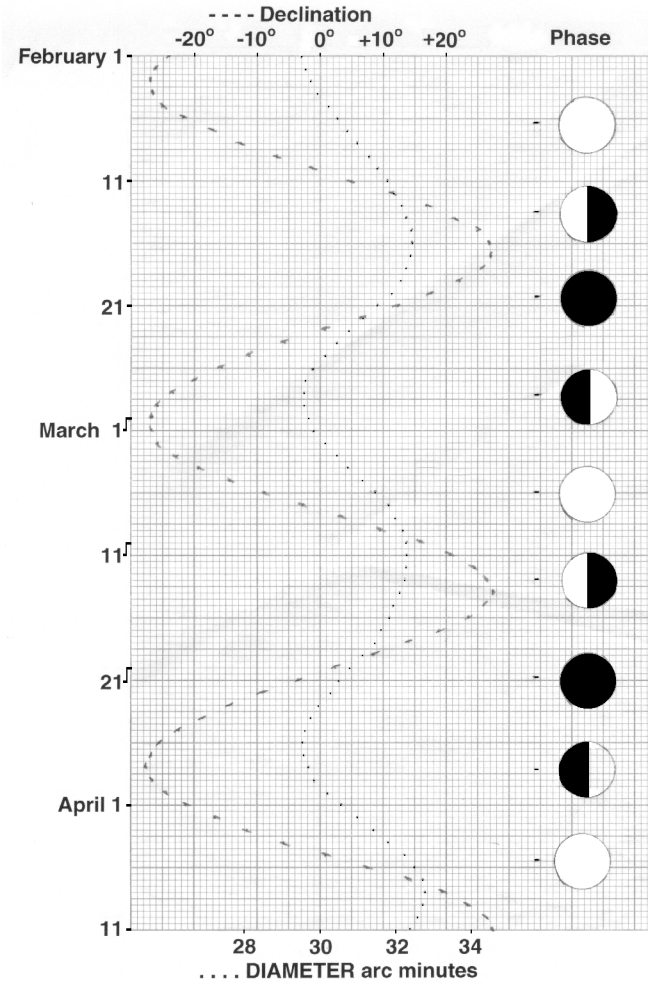
by

Ralph Proctor

Mercury begins February 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 third week in February. Mercury reaches superior conjunction with the Sun on 4 March and re-emerges from the Sun's glare as an evening during the last week in March. Mercury reaches a greatest eastern elongation of 19 degrees on 29 March when it will be very low and bearly visible.

Venus begins February as an evening object high in the western sky and slowly rises higher in the western sky during February and March.

Lunar Declination and Diameter:



The Moon's waxing gibbous phase will be positioned high on the ecliptic and in excellent photographic position during February (February 3) and March (March 1 and 27), with an apparent declination of up to +27 degrees.

Mars begins February as an evening object high in the western sky in the constellation Pisces, but quickly moves into the constellation Aries. During February and March Mars moves lower in the western sky, decreases in brightness from magnitude +0.7 to + 1.4 and decreases in diameter from to 6.7 to 4.9 arc seconds.

Jupiter begins February as a morning object high in the eastern sky in the constellation Leo. During February and March Jupiter moves higher in the eastern sky, reaching opposition with the Sun on 4 March when it will be well placed for photography with a declination of + 6 to + 9 degrees. During February and March Jupiter increases in brightness from magnitude -2.4 to -2.5, and increases in diameter from 43.0 to 44.6 arc seconds.

Saturn begins February as an evening object low in the western sky in the constellation Gemini. During February and March Saturn moves lower in the western sky, decreases in brightness from magnitude -0.3 to +0.1, and decreases in diameter from 20.6 to 18.4 arc seconds.

Uranus begins February lost in the Sun's glare but emerges from the Sun' glare in mid-March as a morning object low in the eastern sky in the constellation Aquarius. During February and March Uranus moves higher in the eastern sky, remains constant in brightness at magnitude +5.9, and increases in diameter from 3.37 to 3.38 arc seconds. Uranus is located at R.A. 22 hours 18.3 minutes declination -11 degrees 19 minutes on 14 February and at R.A. 22 hours 24.7 minutes declination -10 degrees 42 minutes on 15 March.

Neptune begins February lost in the Sun's glare but emerges from the Sun' glare in late February as a morning object low in the eastern sky in the constellation Capricornus. During February and March Neptune moves higher in the eastern sky,

increases in brightness from magnitude +8.0 to +7.9, and increases in diameter from 2.20 to 2.23 arc seconds. Neptune is located at R.A. 21 hours 03.1 minutes declination -16 degrees 52 minutes on 14 February and at R.A. 21 hours 07.3 minutes declination -16 degrees 34 minutes on 15 March.

Pluto begins February as a morning object low in the eastern sky. During February and March Pluto moves higher in the eastern sky, and remains constant in brightness at magnitude +13.9. Pluto is located at R.A. 17 hours 26.4 minutes declination -14 degrees 30 minutes on 15 February and at R.A. 17 hours 28.0 minutes declination -14 degrees 26 minutes on 15 March.

Events:

Mars will be occulted by the Moon on 26 February (02 hours Universal Time) for the South Pacific Ocean; and on 26 March (00 hours Universal Time) for northern Japan, northern Russia, the Arctic regions, northern Scandinavia, the northern British Isles, Greenland, northern Canada, and Alaska.

The Moon will undergo a total eclipse on 4 May for all Antarctica, Australasia, all but the north eastern portion of Asia, southern Japan, Africa, the Indian Ocean, Europe, and the eastern portion of South America. The Moon enters and leaves the penumbra at 17 hours 50.8 minutes and 23 hours 09.5 minutes Universal Time respectively. The Moon enters and leaves the umbra at 18 hours 48.2 minutes and 22 hours 12.1 minutes Universal Time respectively. The Moon enters and leaves totality at 19 hour 52.0 minutes and 21 hour 08.3 minutes Universal Time respectively. Mid-eclipse occurs at 20 hour 30.1 minutes Universal Time.

MINOR PLANETS

		Position			
		14 February		15 March	
Planet	**Magnitude**	**R.A.**	**Decl.**	**R.A.**	**Decl.**
Ceres	07.2 - 08.2	07 hr 00.8 min	+32 deg 13 min	07 hr 03.7 min	+31 deg 57 min
Pallas	09.2 - 09.3	02 hr 18.2 min	- 15 deg 17 min	03 hr 03.6 min	- 10deg 16 min
Juno	11.4 - 11.2	18 hr 28.4 min	- 12 deg 13 min	19 hr 02.0 min	- 10 deg 28 min
Vesta	07.8 - 07.9	20 hr 09.5 min	- 20 deg 34 min	21 hr 12.6 min	- 17 deg 33 min

CELESTRON ACCESSORIES
*****BELOW COST SALE*****

Powerstar Mount(with declination motor)..$969.00
26mm Plossl Eyepiece.....$54.00

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Volume No. 6 issue 6
Volume No. 7 issue 5 and 6
Volume No. 8 issue 1[1], 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 2, 5, and 6
Volume No. 25 issue 1, 2, 3, 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.

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Photographing Face-on Galaxies

by

Robert C. Price

Winter is the best time to photograph face-on galaxies. Several of the largest and brightest face-on galaxies are located high in the winter sky. M33 is the largest and is located overhead at sunset. M51 is one of the brightest face-on galaxies and is also located high in the winter sky about 2 AM.

M33 in Triangulum is a difficult object to photograph. Despite its large size, M33 has a very low surface brightness and thus requires dark skies and long exposures to capture. M33 has several large H-alpha gas clouds that show up as red/magenta areas in long exposure color images. M33 is a member of the Local Group and its estimated distance is 2.4 million light years.

M51, located just off the upper handle of the Big Dipper, is a large Sc galaxy with a physical companion galaxy. M51 is about the same physical size as M31, some 100,000 light years in diameter, and is easy to photograph because it is one of the brighter galaxies. M51 is located at an estimated distance of 35 million light years.

M61 in Virgo is one of the largest galaxies in the Virgo Cloud and is located at an estimated distance of 60 million light years.

M74 is an 11th magnitude Sc spiral galaxy in Pisces and is located at an estimated distance of 33 million light years. The exact distance to M74 is uncertain because the distance derived from its red shift is significantly more than its estimated distance derived by other methods.

M77 is a three-armed Sb spiral and a Seyfert type galaxy. Seyfert type galaxies are galaxies whose nucleus reveal strong emission lines and are a strong radio source. M77 is located at an estimated distance of 77 million light years.

M99 is a two-armed spiral that appears to have 3 arms. The third apparent arm consists of a series of short segments that actually radiate from one of the main arms which is located on the northeast side. Estimated distance is 50 million light years, but like M74 a greater distance can be derived from its red shift.

M100 is the largest spiral galaxy in the Virgo-Coma Galaxy Cluster. M100 is located at an estimated distance of 40 million light years.



Above: Face-on spiral galaxy NGC 1232 in Eridanus photographed by Chuck Vaughn using a 12.5 inch F/9 Ritchey-Chretien. Exposure was 120 minutes on hypersensitized Kodak 2415.

Face-on Galaxies

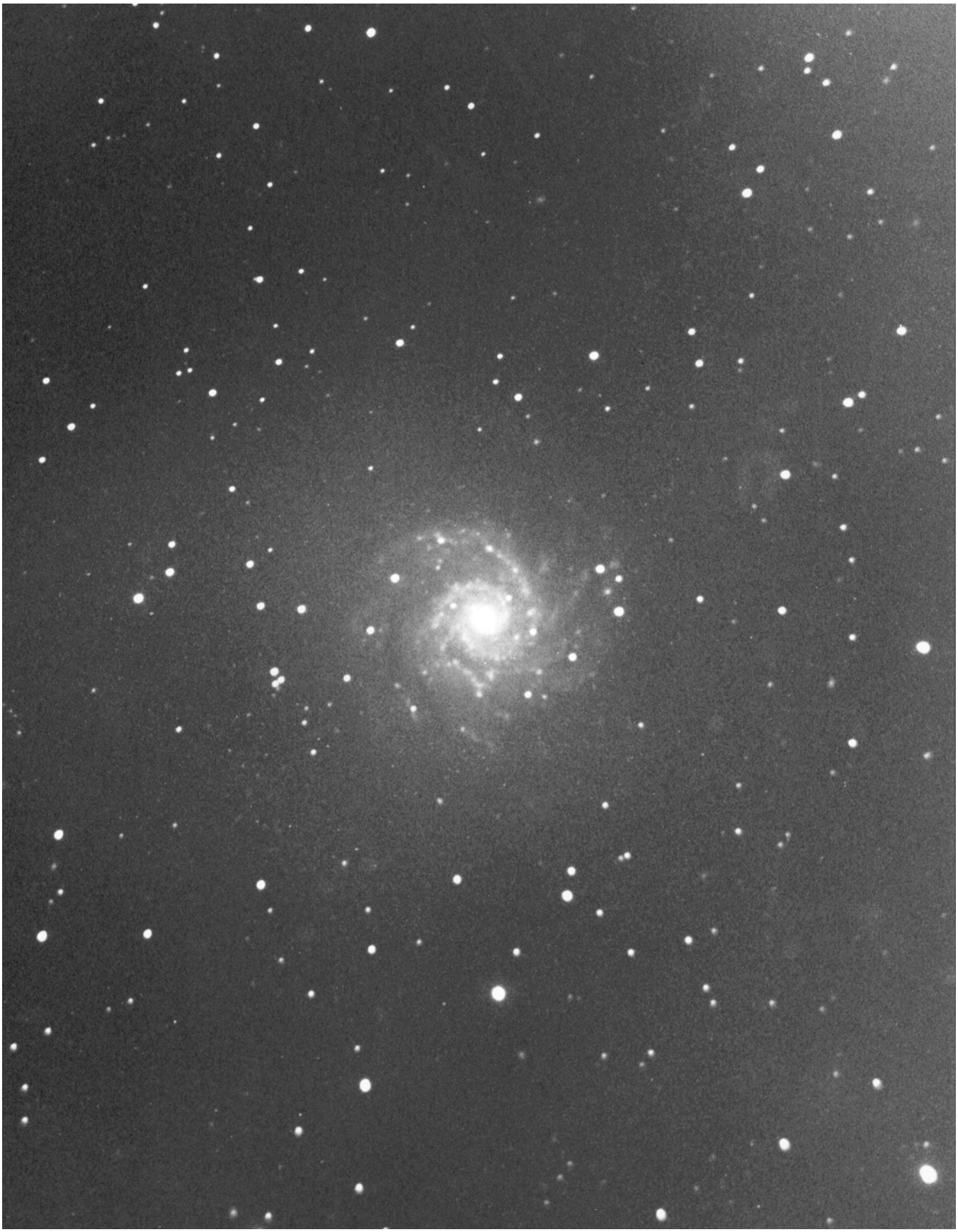
Name	Location	Mag.	Size	Location		Description
				R.A.	Decl	
M33	Triangulum	6.6	60’ x 40’	01 hr 31.1 min	+30 deg 24 min	Sc, Pinwheel Galaxy
M51	Canis Venatici	8.7	10.0’ x 5.5’	13 hr 27.8 min	+47 deg 27 min	Sc, Whirlpool Galaxy
M61	Virgo	10.2	5.7’ x 5.5’	12 hr 19.4 min	+04 deg 45 min	Sc spiral
M74	Pisces	11.0	9.0’ x 9.0’	01 hr 34.0 min	+15 deg 32 min	Sc spiral
M77	Cetus	10.0	2.5’ x 1.7’	02 hr 40.1 min	- 00 deg 14 min	Three-armed Sb spiral
M83	Hydra	8.0	10.0’ x 8.0’	13 hr 34.3 min	- 29 deg 37 min	Two-armed Sc spiral
M94	Canes Venatici	8.9	5.0’ x 3.5’	12 hr 48.6 min	+41 deg 23 min	Sb spiral
M99	Coma Berenices	10.4	4.5’ x 4.0’	12 hr 16.3 min	+14 deg 42 min	Sc spiral
M100	Coma Berenices	10.4	5.2’ x 5.0’	12 hr 20.4 min	+16 deg 06 min	Sc spiral
M101	Ursa Major	9.0	22’ x 20’	14 hr 01.4 min	+54 deg 35 min	Sc spiral
NGC 488	Pisces	11.2	3.5’ x 3.0’	01 hr 19.1 min	+05 deg 00 min	Sb spiral
NGC 1232	Eridanus	10.7	7.0’ x 6.0’	03 hr 07.5 min	- 20 deg 46 min	Multi-armed Sc spiral
NGC 2403	Camelopardalis	8.8	16’ x 10’	07 hr 32.0 min	+65 deg 43 min	Sc spiral
NGC 3147	Draco	11.3	3.0’ x 2.3’	10 hr 12.8 min	+73 deg 39 min	Sb spiral
NGC 6946	Cepheus	11.1	8.0’ x 8.0’	20 hr 33.9 min	+59 deg 58 min	Sc spiral
NGC 7217	Pegasus	11.3	2.7’ x 2.4’	22 hr 05.6 min	+32 deg 07 min	Sb spiral
I.342	Camelopardalis	12.0	15’ x 15’	03 hr 41.9 min	+67 deg 57 min	Sc spiral



Above: Face-on spiral galaxy NGC 4535 in Virgo photographed by James Foster from Mt. Pinos CA in January 1991 using an 11 inch Celestron at F/11. Exposure was 210 minutes on hypersensitized Kodak 2415 developed in D-19 for 9 minutes at 68°F.



Above: Face-on spiral galaxy M51 photographed by Christian Viladrich on 7 December 1985 from France using a 190 mm F/4 flat field camera. Exposure was 40 minutes on hypersensitized Kodak 2415.



Above: Face-on spiral galaxy M74 photographed by Harvey Freed on 21 October 1990 using a 10 inch F/10 SCT at F/6.3. Exposure was 58 minutes on hypersensitized Kodak 2415.



Above: Face-on spiral galaxy M33 photographed by David Healy on 14 September 1993 a 14 inch Celestron at F/7 and ST-4 guider. Exposure was 70 minutes on hypersensitized Kodak 2415.