

Astrophotography

A Brief Overview

By Sam Pitts

1/28/2000

Camera Selection

Manual Single Lens Reflex with B setting & Mirror Lockup

★ **Canon F-1**

★ **Nikon F & F2**

Olympus OM-1, 2 or 3

Pentax K1000 & LX

Canon FTb (QL)

Contax S2

Praktica

Lecia Very Expensive

All in 35mm Format

Camera Lenses

Astrophotography requires the best lenses.

Fast lenses f/1.2 - f/4 by Nikon, Canon, Tokina, Zeiss, etc.



Fixed Focal lengths are best



Zoom lenses are usually to SLOW & Hard to Focus

24 - 135mm f/1.2-2.8 : Constellations & wide Views

100 - 300mm f/2.8-f/4 : Large Deep Sky Objects

350 - 1000mm f/2.8-f/8: Deep Sky Objects

LENSES

The Best lenses DO NOT stop Aberrations

Stop down 1/2 - 2 f-stops depending on Lens Quality

24-90mm Focal Lengths

f/1.2 to 1.4, 1.8, 2.0, 2.4, 2.8

50 mm = 1x

100 mm = 2x

300 mm = 6x

500 mm = 10x

FILM

Fast Film:

Easier to get Results

Shorter Exposures

Less can go Wrong

More Grain

Less Quality

Slow Film:

Best Quality

More can go Wrong

Long Exposures

FAVORITE FILMS

Slides

- ★ Fujichrome MS 100/1000
- ★ Fujichrome 400
- Fujichrome 1600D
- ★ Provia 400P
- ★ Ektachrome P800/1600
- Agfachrome 1000
- Fujichrome RD100
- Kodachrome 25,64 & 200
- Vulvia 50

Prints

- Fuji Color HG 1600
- ★ Fuji Color HG 800
- Fuji Color HG 400
- Ektar 1000
- ★ Konica SR-G 3200
- ★ Kodak Royal Gold 1000
- ★ Tech Pan 2415 Black & White
- ★ PPF
- PJ400 & 800

★ **Hyper-Film** ★

TRIPOD PHOTOGRAPHY

Excellent Way to Start

Star Trails:

5-60 Minutes (Dark Sky)

24-100mm f/2.8-f/4

400 asa film

Constellations:

10-20 sec. (Dark Sky)

50-100mm f/1.4-f/2

400-3200 asa film

Planets:

4-20 sec. (Dark Sky)



Tripod: 50mm f/1.8 1 minute Scotchchrome 400(H)
9/19/99 F



Tripod: 50mm f/1.8 45 sec. Scotchchrome 400(H)
9/19/99 F



Tripod: 50mm f/1.8 30 sec. Scotchchrome 400(H)
9/19/99 F

RECIPROCITY FAILURE

Keep Piggyback exposures to 30 minutes

60 min. exposure does not record twice as much light as a 30 min. exposure. Each film has a different rate of Reciprocity Failure.

400asa film can drop to 200asa after 2 minutes

SKY FOG

Based on f/ratio of System used

Elevation

Sky Conditions



Orion 50mm f/1.4 @ 5 min. Scotch 400(H) 9/19/99 F



Orion 50mm f/2.8 @ 5 min. Scotch 400(H) 9/19/99 F

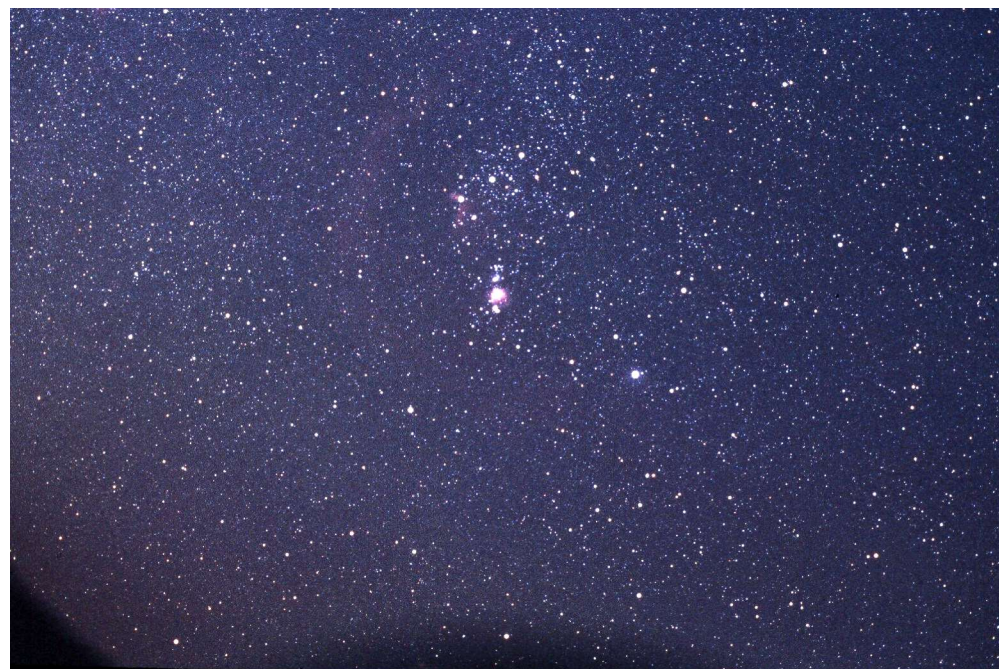


← **50mm f/1.4 @ 5 min.**

**Sky Fog
Aberrations**

50mm f/2.8 @ 5 min. →

**Stepped Down
Two full Stops**



SKY FOG TABLE

No Filters Used

<u>f/Ratio</u>	<u>Minutes</u>
f/1.2	1 - 2.5
f/1.4	1.5 - 3
f/2	4 - 7
f/2.4	6 - 8.5
f/2.8	8 - 12
f/4	16 - 22
f/5.6	32 - 45
f/8	60 - 90
f/11.3	120 - 180
f/16	160 - 360

THE RIGHT TELESCOPE

The Mount is more important than Optics !

Solid Equatorial Type Mounts

Quality Clock Drives

+/- 5 arc Sec.

PEC (Periodic error correction)

Aperture is important only for the Moon & Planets

4" Minimum For Lunar & Planetary Work

Focal Ratio is important for Deep Sky Work

No Slower than f/10, f/4 - f/6 is Best

Portable to Dark Sky Locations

THE RIGHT TELESCOPE

Good Optics

8 inch Schmidt-Cassegrain

3-4 inch short Focus f/5-f/8 Apochromatic Refractor

Quality Newtonian 6-8 inch. F/6

Meade

Celestron

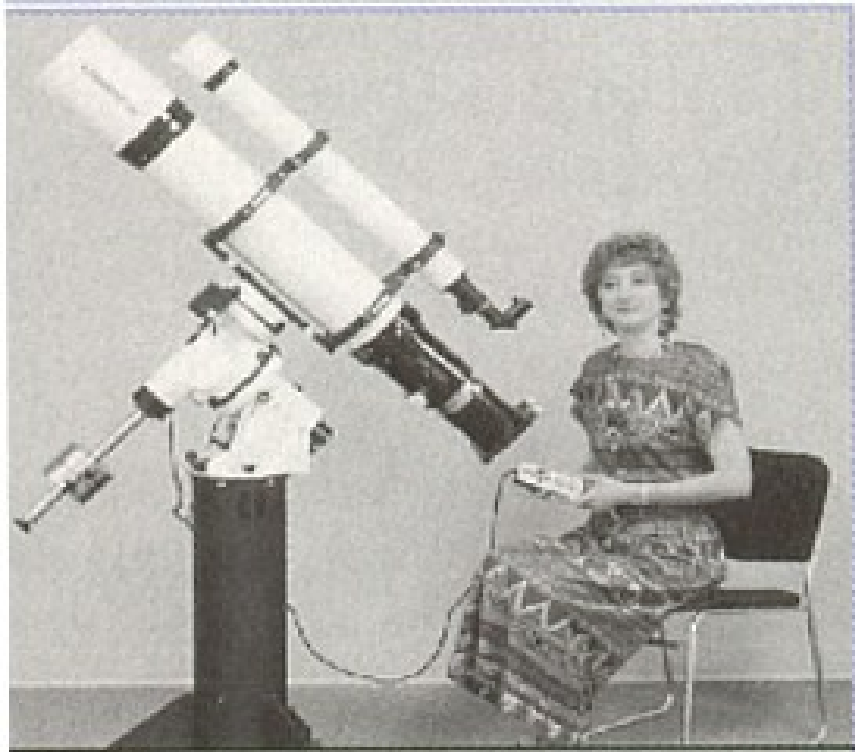
Astro-Physics

Takahashi

Tele Vue

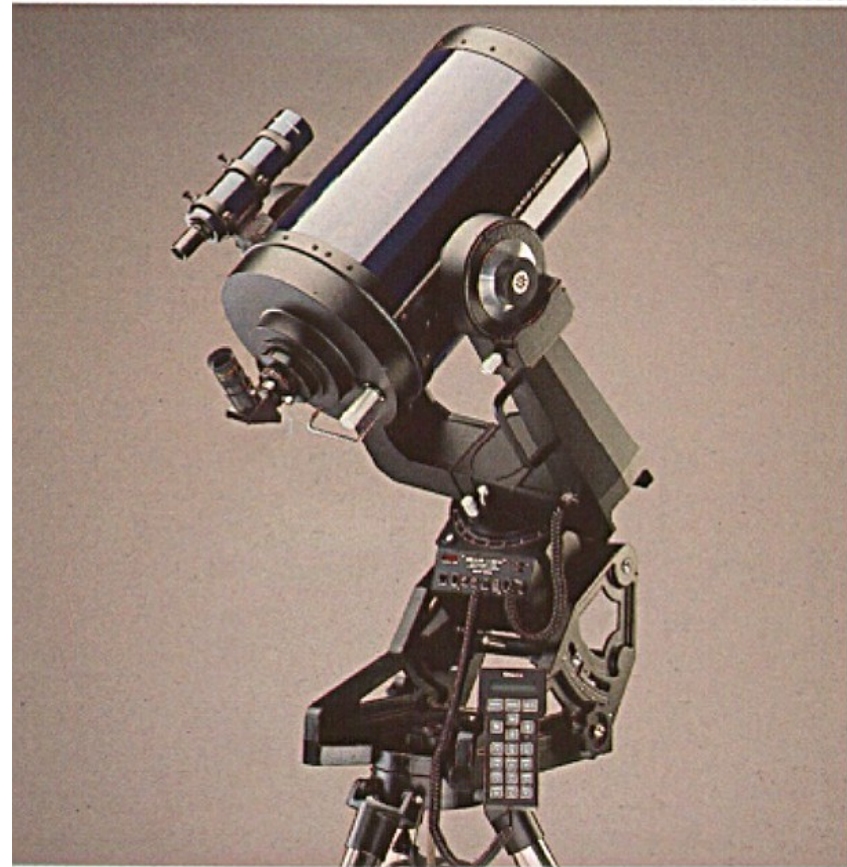
Parks

Losmandy



155 StarFire EDF with 4" Focuser,
900 German Equatorial
80mm Guidescope, accessories

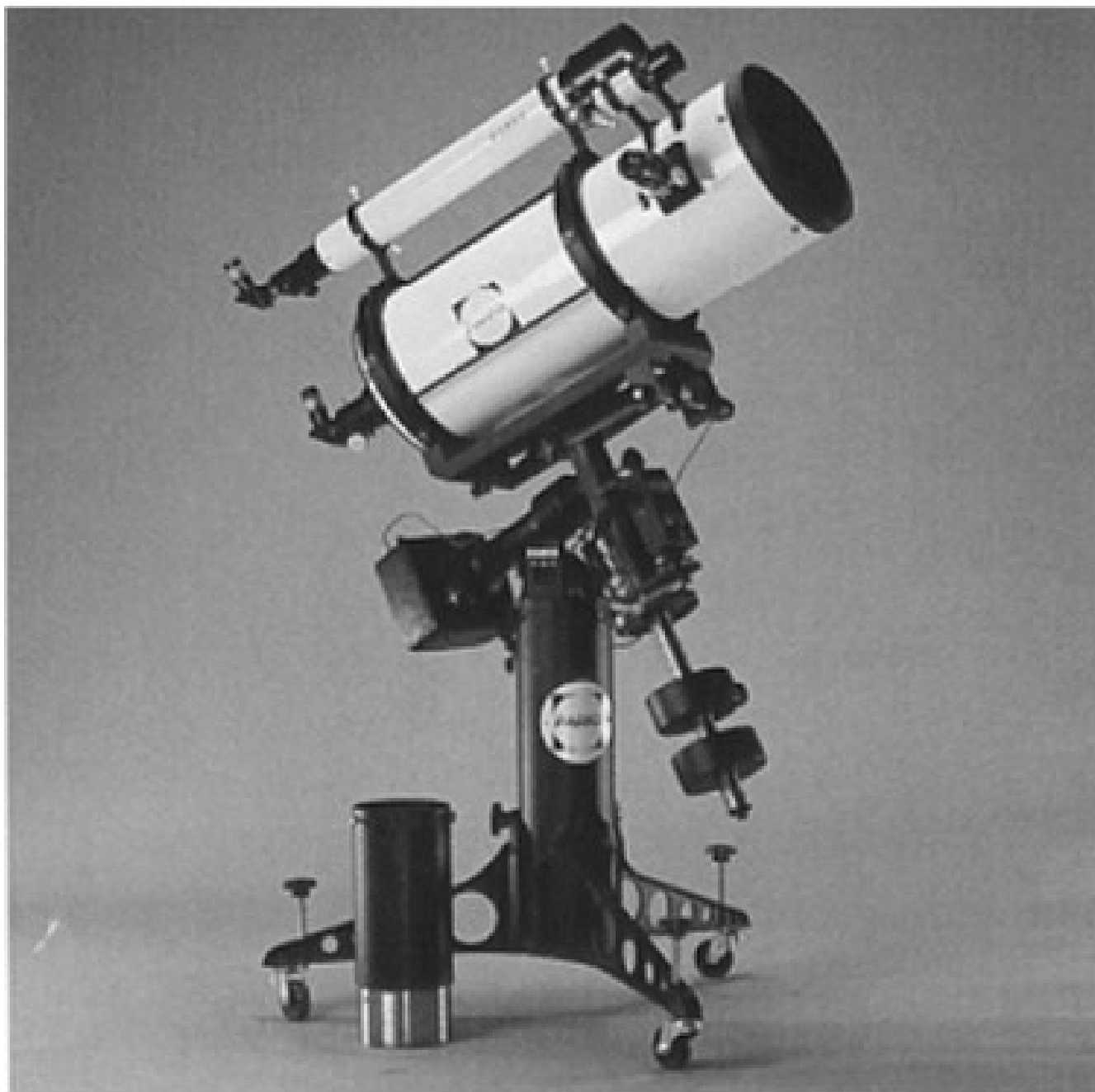
Meade 10" Model LX200 Schmidt-Cassegrain; shown with optional Superwedge.



Astro-Physics

Meade

Losmandy



Parks
10" f/3.5 &
f/12 H.I.T.

Accessories

Piggyback Mount

T-Rings & Camera Adapters

Counterweights

Tele-Extender & Projection Tube

Eyepieces 26mm-5mm & 2x Barlow

Cable Release & Timer

Good Star Charts

Focal Reducer / Field Flattener

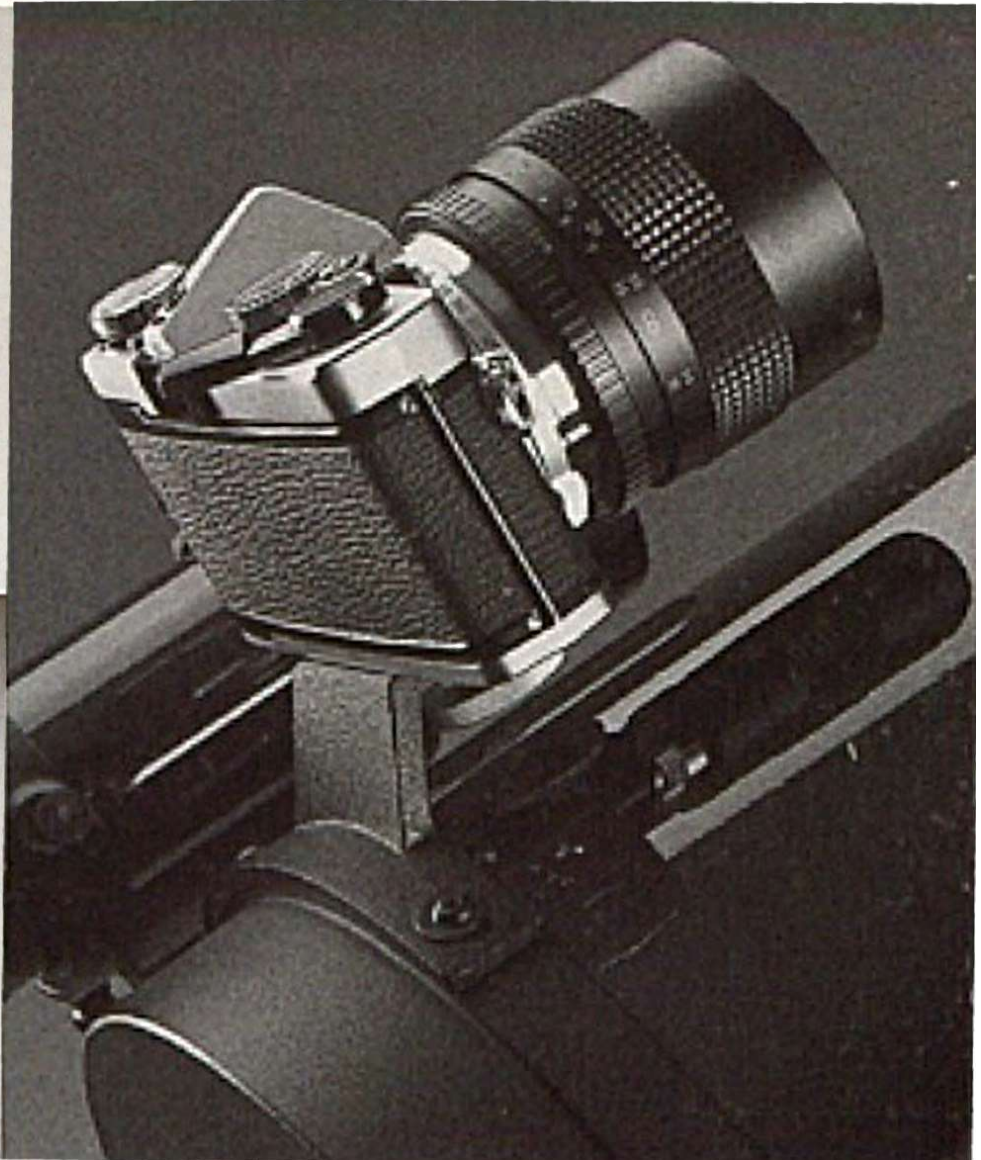
Off-Axis Guider

Guiding Eyepiece

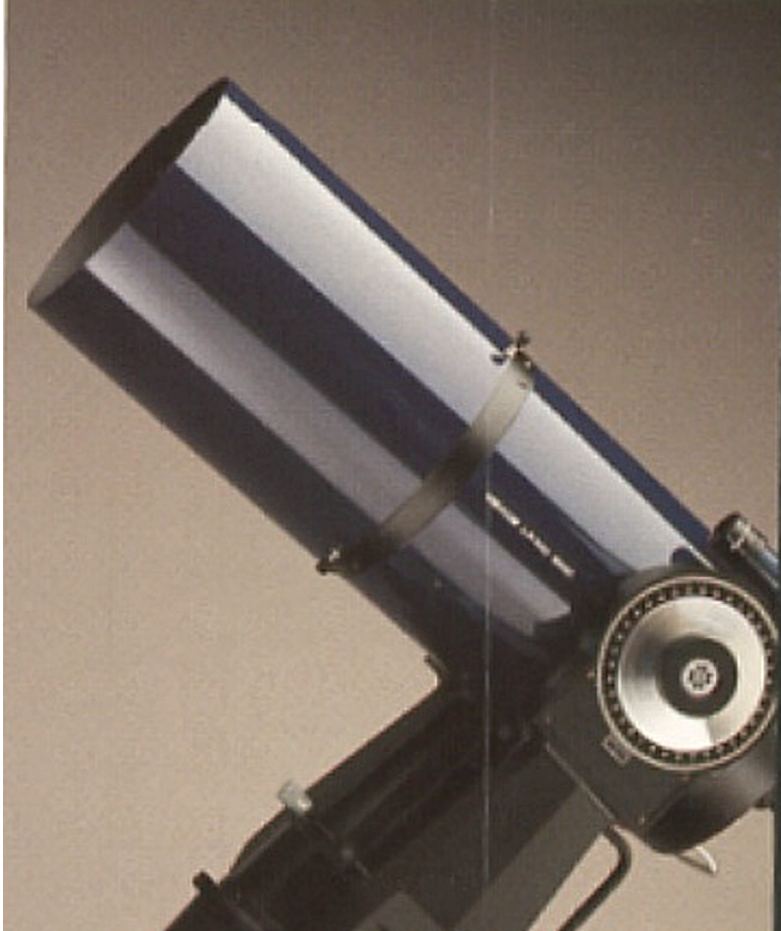
Comfortable Chair & Table



9mm Cross-Hair Eyepiece



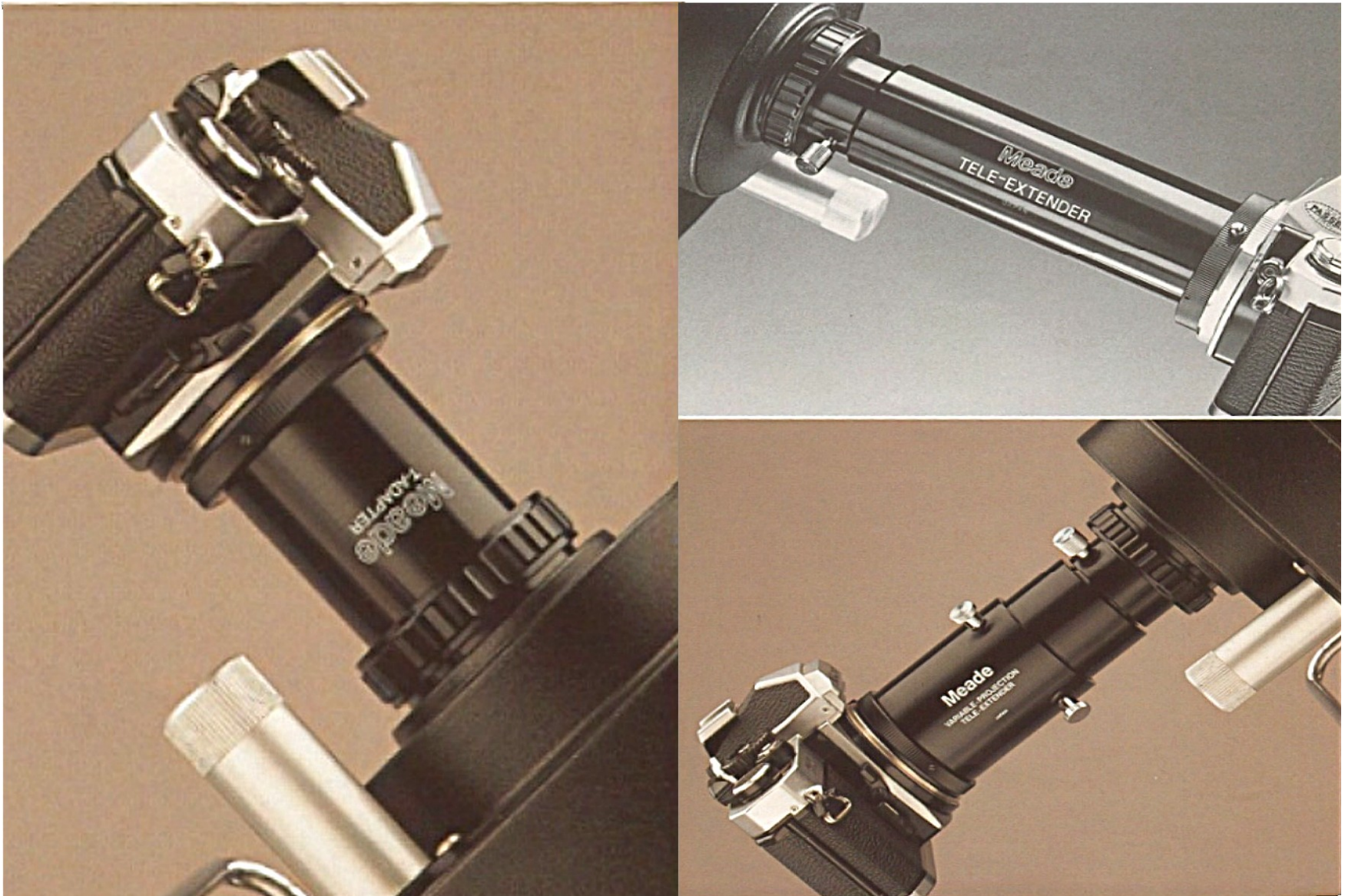
Piggy-back Adapter



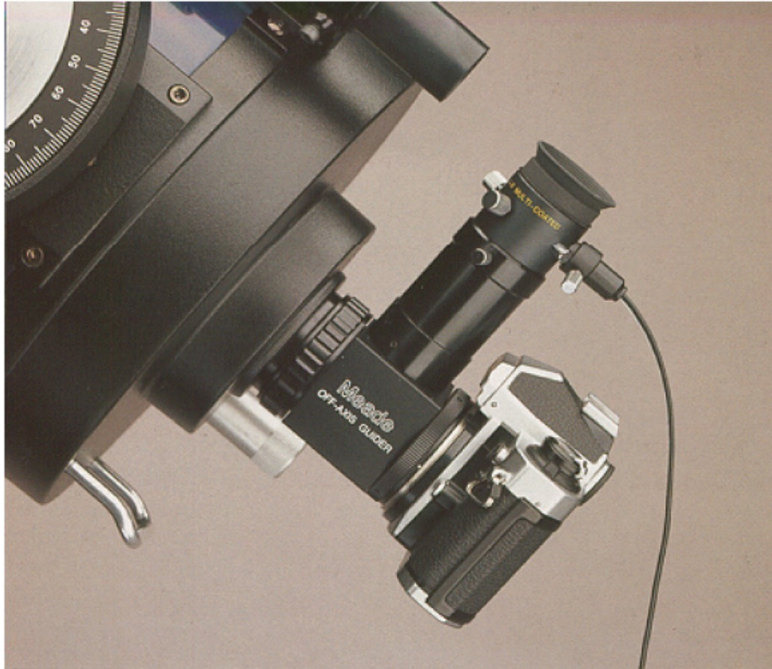
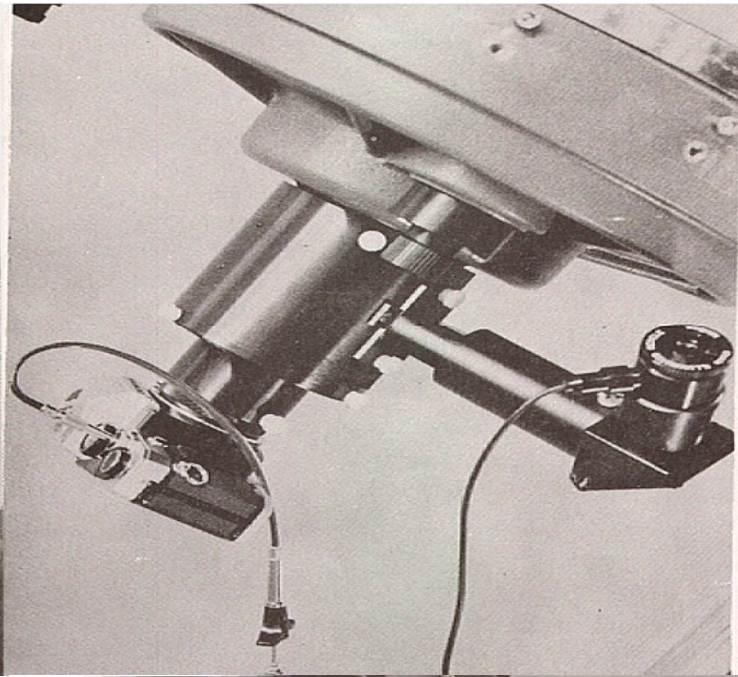
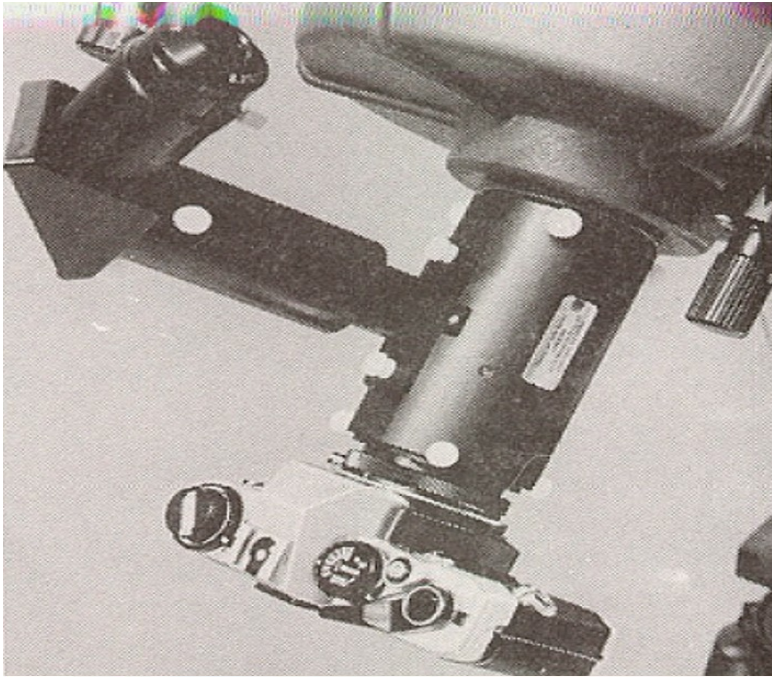
Dew Shield

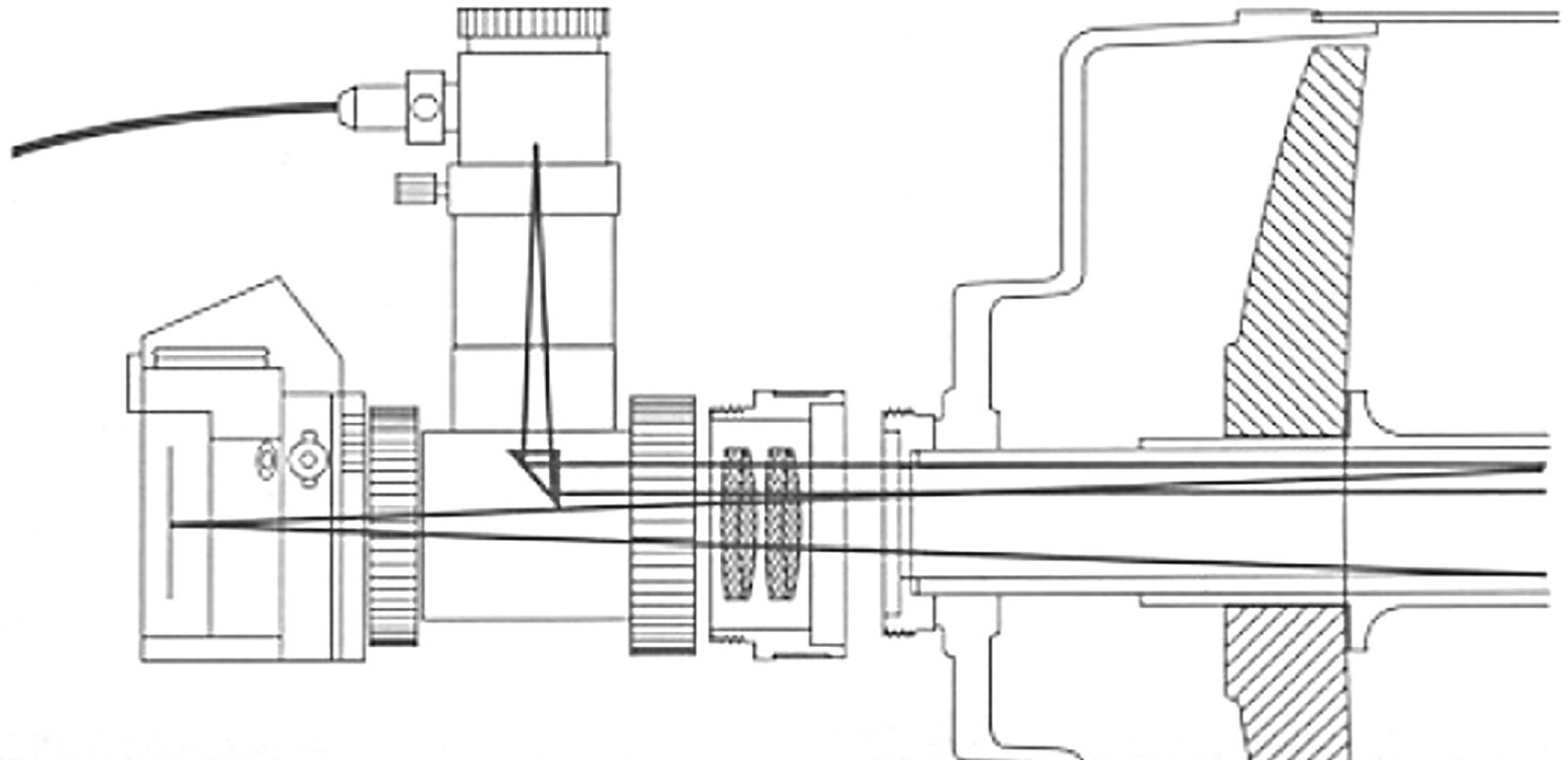
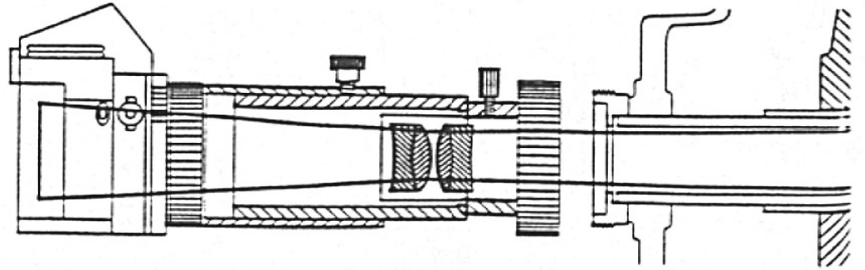
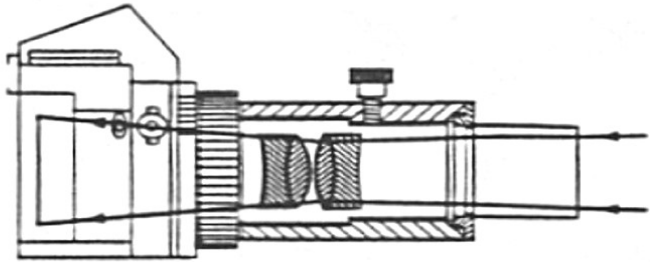
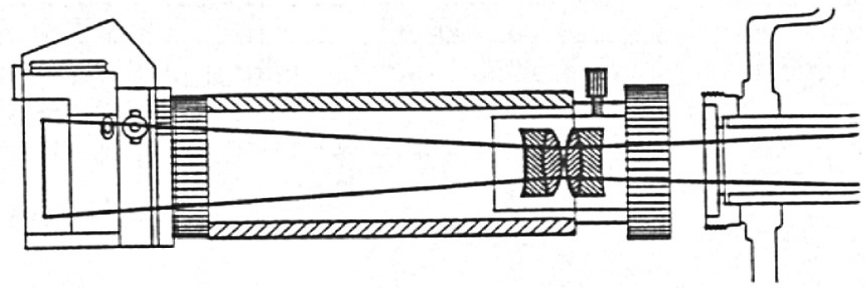
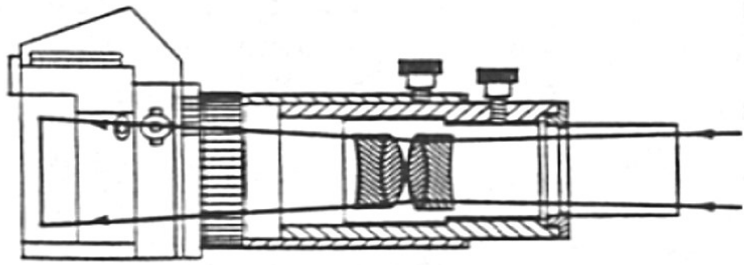


**Variable-Projection
Camera Adapter**



Various Camera Adapters





Piggyback

Solid Mount

Good Focus

20mm-50mm Unguided

100mm-500mm need to Guide

Guide with Minimum of 10 times

the magnification of the Photo-image

Guide with no less than 100x

4 - 8 minutes @ f/2.4

20-90 minutes f/4 - f/8

Each f/stop doubles your exposure time



M45 300mm f/4 2 min.

Fuji M/S 400(H)

9/10/99 OSP

M45 300mm f/4 15 min.

Fuji M/S 400(H)

9/10/99 OSP





M16 & M17 300mm f/4 14 minutes Fuji M/S 400(H)

OSP 9/10/99



M24, M25 300mm f/4 10min. E200-400(H)_{9/11/99} #7 OSP



M6 & M7 100mm f/2.8 8 minutes Scotchchrome 800

7/7/99 #4 PMO



M15 100mm f/2.8 10 minutes Scotchchrome 800

7/7/99 #20 PMO



M27 100mm f/2.8 12 minutes Scotchchrome 800

7/7/99 #21 PMO



M57 100mm f/2.8 10 minutes Scotchchrome 800

7/7/99 #22 PMO



M11,M26 100mm f/2.8 10 minutes Scotchchrome 800

7/7/99 #223 PMO



Orion-M42 Nebula 300mm f/4 5 min. Scotch 400(H)

9/19/99 F #9



M 33 Galaxy 300mm f/4 12 Min. E200-400 (H)_{9/11/99} OSP 20



Andromeda 100mm f/2.8 25min. Scotchchrome 800

7/7/99 PMO



M-31 300_{mm} f/4 30 min. Fuji M/S 400 (H) 9/10/99 OSP #9



M-31 300_{mm} f/4 30 min. Fuji M/S 400 (H) 9/10/99 osp#9 2X



M82 M81 300mm f/4 15min. Fuji M/S 400(H) 9/10/99 OSP #6



M8 & M20 (Top) 300mm f/4 20min. Fuji M/S 400(H)_{9/10/99} #4 OSP



M22,M28 300mm f/4 10 min. Fuji M/S 400(H) 9/10/99 #22 OSP



M51 300mm f/4 12 min. Fuji M/S 400(H) 9/10/99 #7 OSP

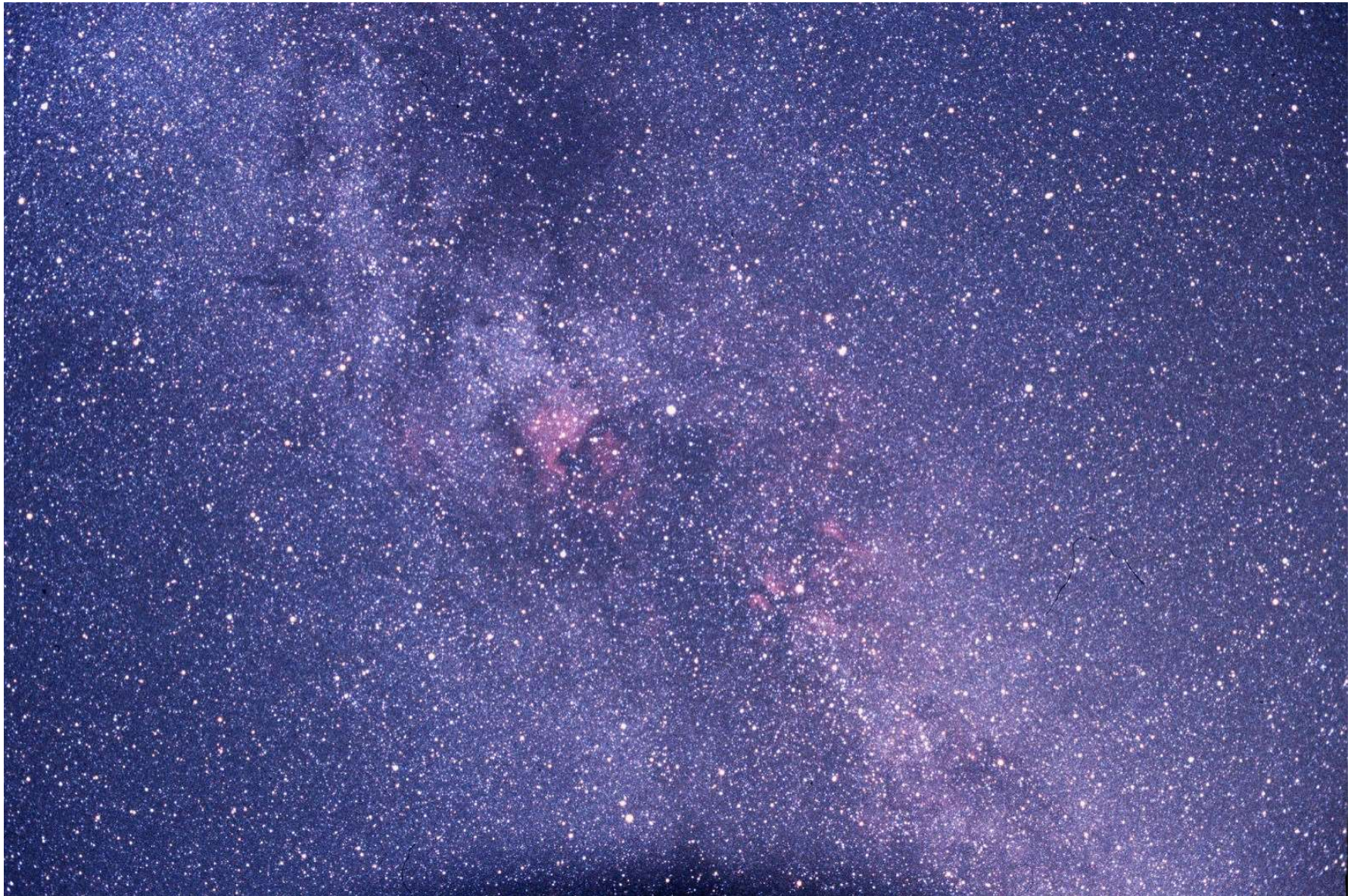


M51 300mm f/4 12 min. Fuji M/S 400(H) 9/10/99 #7 OSP X4

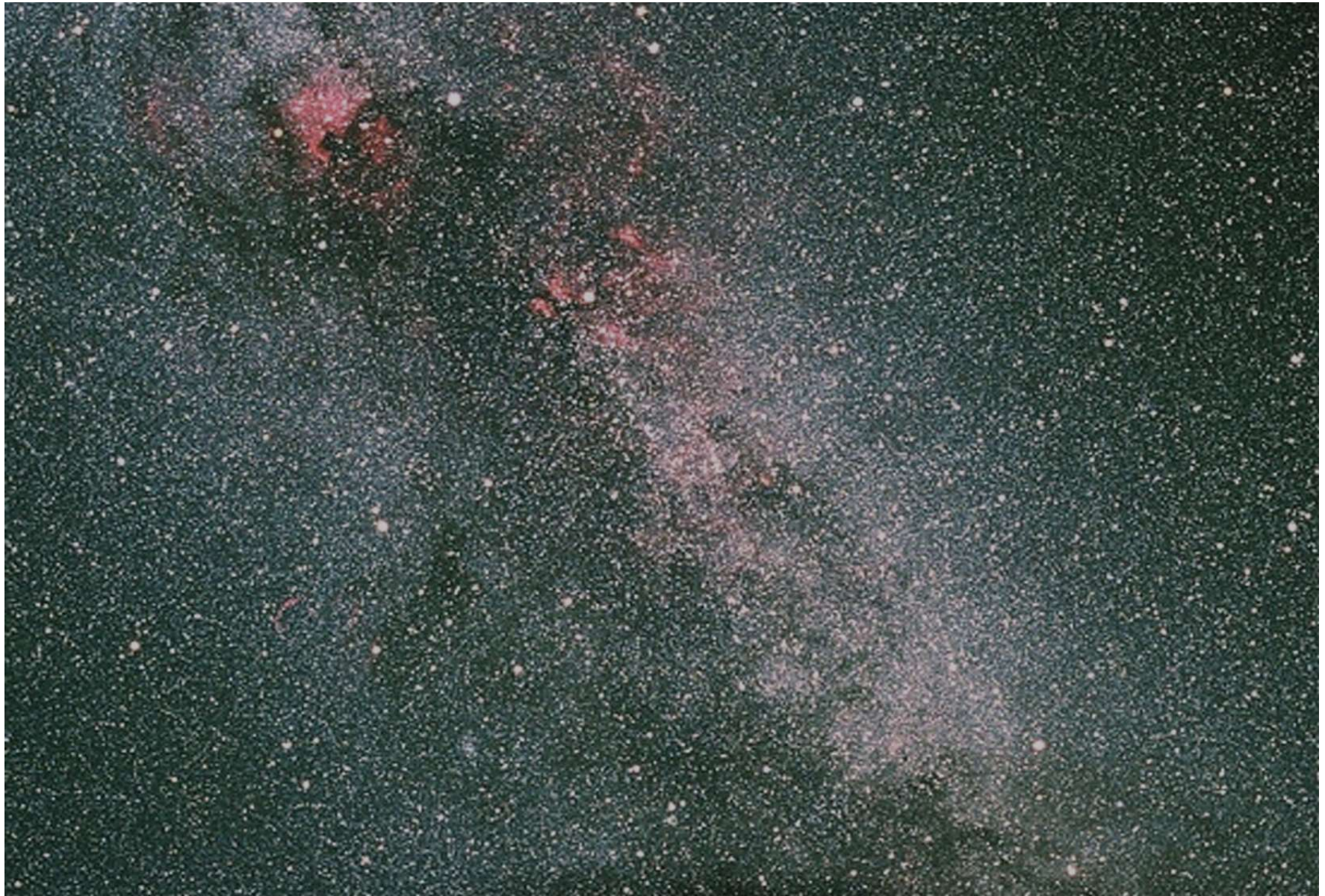


Cygnus / Deneb 28mm f/4 10 min. Fuji M/S 400(H)

9/10/99 #12 OSP



Cygnus 50mm f/2.4 15 min. E200-400(H) 9/11/99 # 14 OSP



Cygnus 50mm f/2.4 12 min. Scotch 400(H) 9/19/99 #7 Foley



Deneb 100mm f/2.8 10 min. Fuji M/S 400(H) 9/10/99 #8 OSP



Deneb 300mm f/4 20 min. Fuji M/S 400(H) 9/10/99 #8 OSP

Prime Focus Deep Sky

Master Piggyback Methods First

Focal Lengths of 750mm - 3000mm

Start with M 42 Orion Nebula or Similar Bright

Object with a 6-10 Minute Exposure @ f/10

★ Take Detailed Notes ★

Examine & Identify all Mistakes

Start with Faster Films & work down

Galaxies & Similar Deep Sky Objects

May Require Exposures of 60-120 Minutes



Orion Flame Nebula 8" SCT f/6 30 min. Fuji M/S 400(H)

9/10/99 OSP # 35



M13 Cluster 8" SCT f/6 20 min. Kodak E200-(400H)

9/11/99 OSP # 15



M31 Andromeda 8" SCT f/6 60 min. Kodak E200-(400H)

9/11/99 OSP # 18



M33 Galaxy 8" SCT f/6 20 min. Fuji M/S 400(H)

9/10/99 OSP # 29



Orion M42 Nebula 8" SCT f/6 15 min. Fuji M/S 400(H)

9/10/99 OSP #34



Orion M42 Nebula 8" SCT f/10 30 min. Fuji M/S 400(H)

9/10/99 OSP #33

Lunar & Planetary

Prime Focus

Barlow Projection

Eyepiece Projection

Focal Lengths to 40,000mm

f/45 to f/200 or more

100 - 400 asa Film

Bracket all Shots

Most Difficult of All Techniques

Close Up Views

Eyepiece Projection

Planets need Minimum Focal Length of 10,000mm

Measure the distance from the eyepiece lens to the

Film Plane in Millimeters; Divide by the Eyepiece's

**Focal Length = Amplification factor of the Telescope's
Focal Length and Focal Ratio.**

8-inch f/10 Schmidt-Cassegrain with an Amplification of

6x Equals = 12,000mm f/60

Lunar Exposures

**Set the Shutter Speed to the Reciprocal
of the ISO Speed of the Film**

Example:

**To photograph an Object in Sunlight @ f/16 with 64_{asa}
= 1/60 sec.**

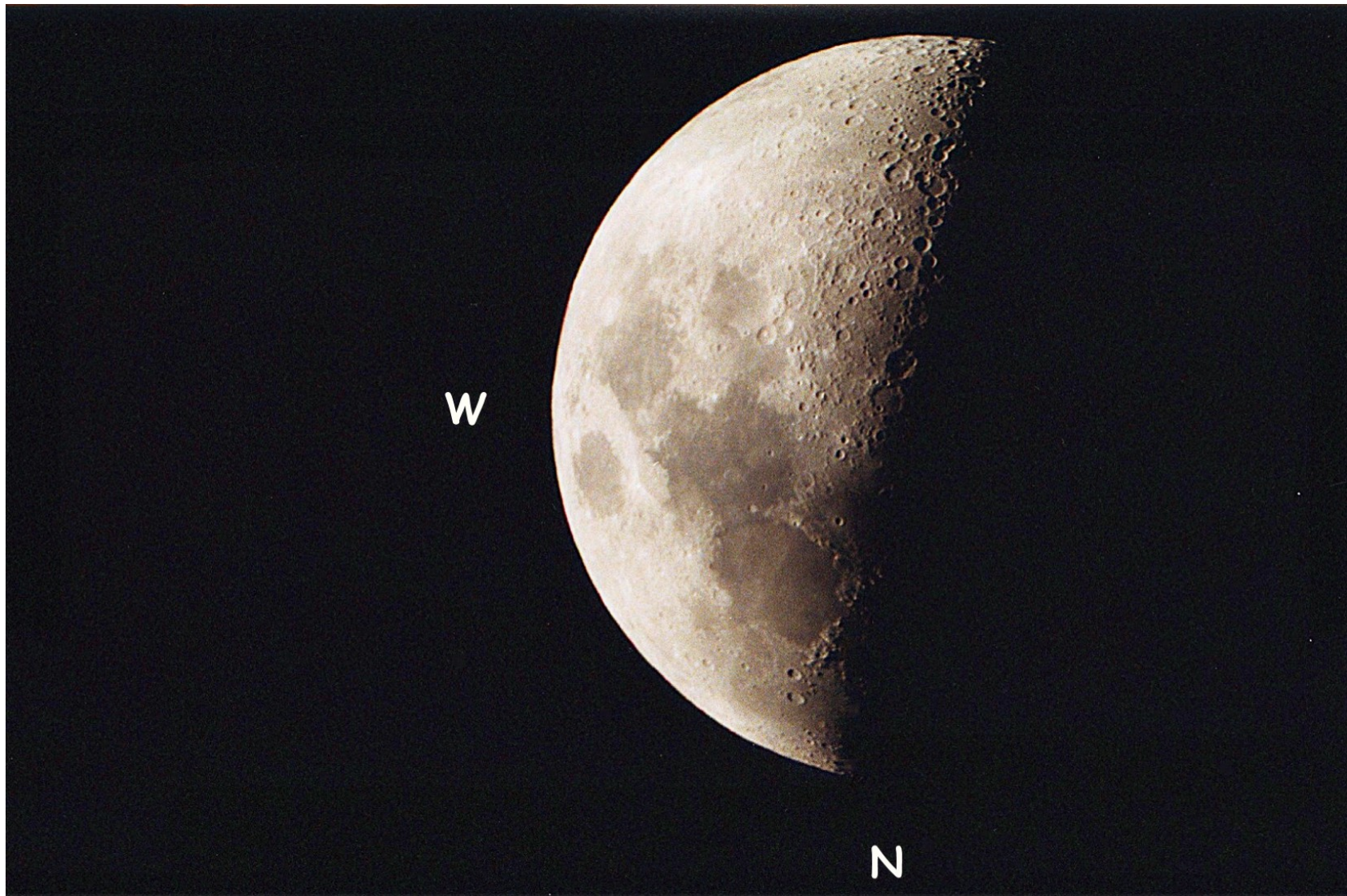
800_{asa} = 1/1000 (1/800)

Remember : Faster f/stop = Shorter Exposure

f/11 (f/10 Telescope) = 1/125 sec. 64 asa

f/8 = 1/250 sec.

F/5.6 = 1/500 sec.



Moon Prime Focus 8" SCT f/10 1/60 sec. Gold 800 Print

7/30/98 Eugene



Prime Focus 8" f/10 SCT 1/125 sec. TMX5052 100asa Print

8/28/98 Eugene # 5



#10 1/8 sec.

16mm Eyepiece Projection

8" SCT

8/29/98 TMX 5052 100asa BW

2.25" from eyepiece to Film Plane=57.15mm

16mm divided into 57.15mm= 3.572x

3.6 x 2000mm= focal length 7200mm

7200mm f/36

f/16 100asa=1/100

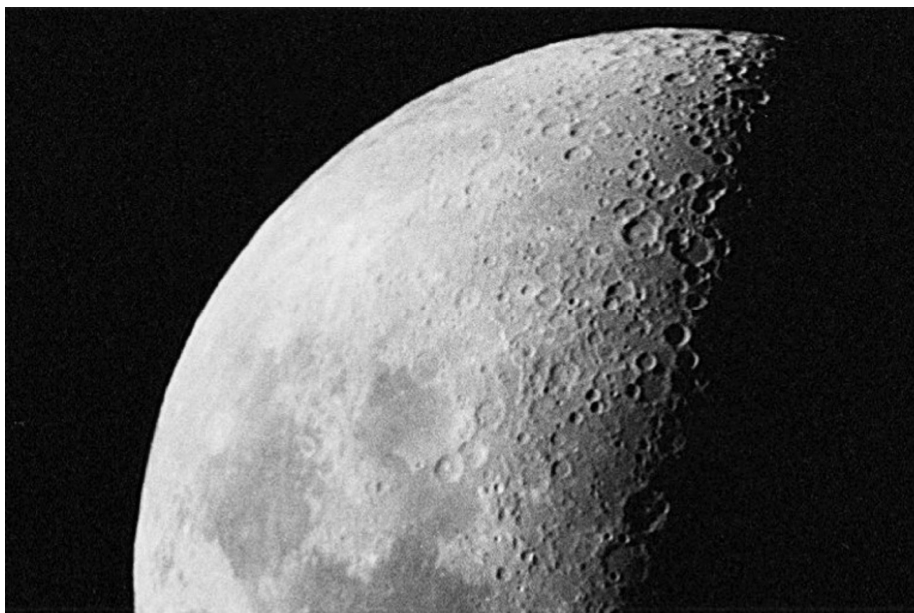
f/22=1/50

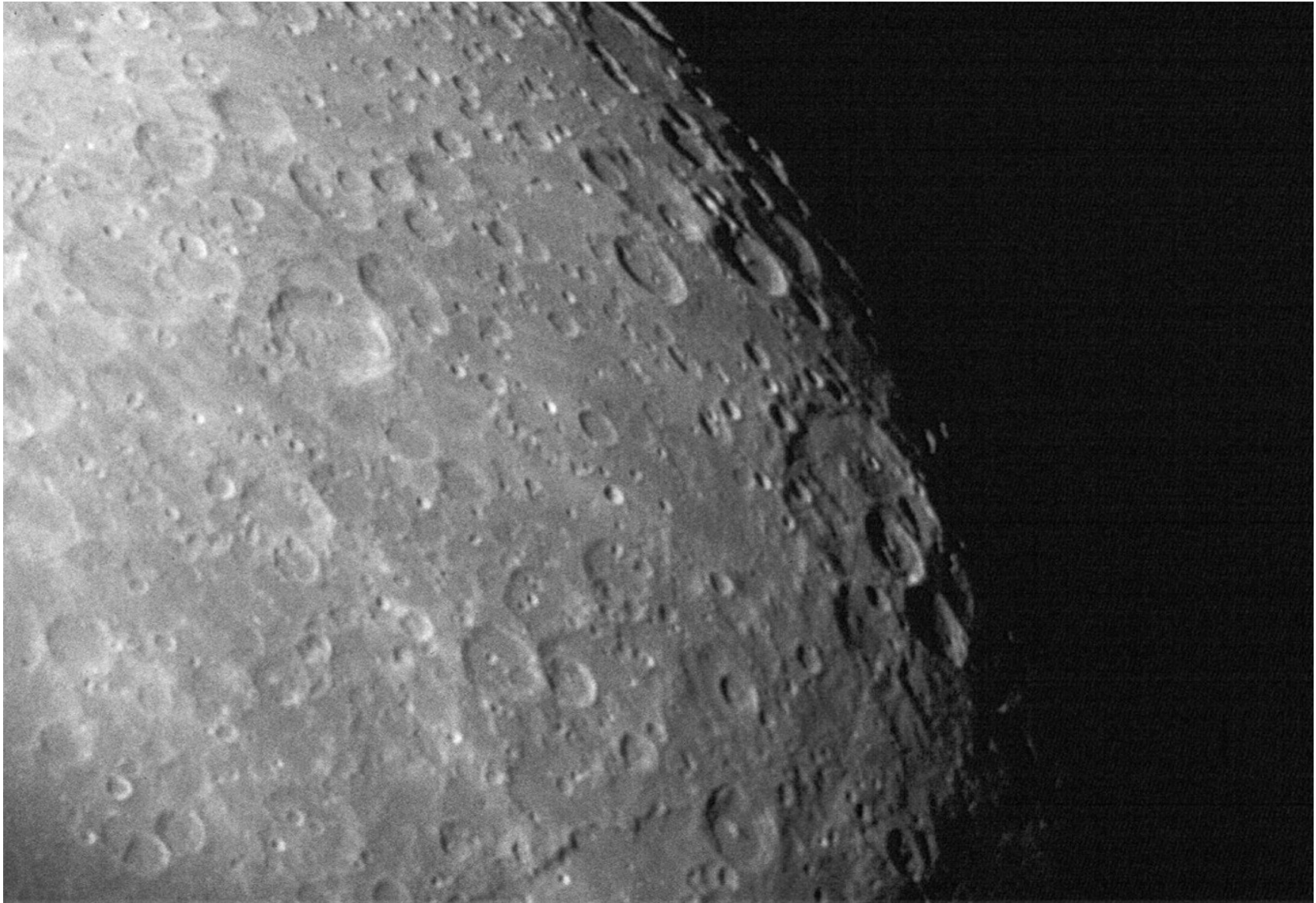
f/32=1/4

f/45= 1/8

Approximately 140x magnification

12 1/4 sec.





7,500mm f/20 1/125 sec. Fuji Chrome 400 7/31/99PMo



14,000mm f/36 1/60 sec. Fuji Chrome 400 7/31/99PMO

Planetary Exposures

20,000mm f/100 200-400asa Films

	<u>Seconds</u>
Venus	1
Jupiter	1/2 - 4
Saturn	2 - 10
Mars	1 - 4
Uranus	300+



Uranus 16mm Projection 30sec. Fuji M/S 400(H) 9/10/99 #27 OSP



Jupiter 8" SCT Projection f/95 1 sec. Fuji M/S 400

8/28/98 PMO #25



Jupiter 8" SCT Eye Piece-Projection 1sec. Fujichrome 400

9/15/98 Eugene # 18



Saturn 15" Projection 2.5 sec. Fujichrome 400

7/31/99 PMO #7a

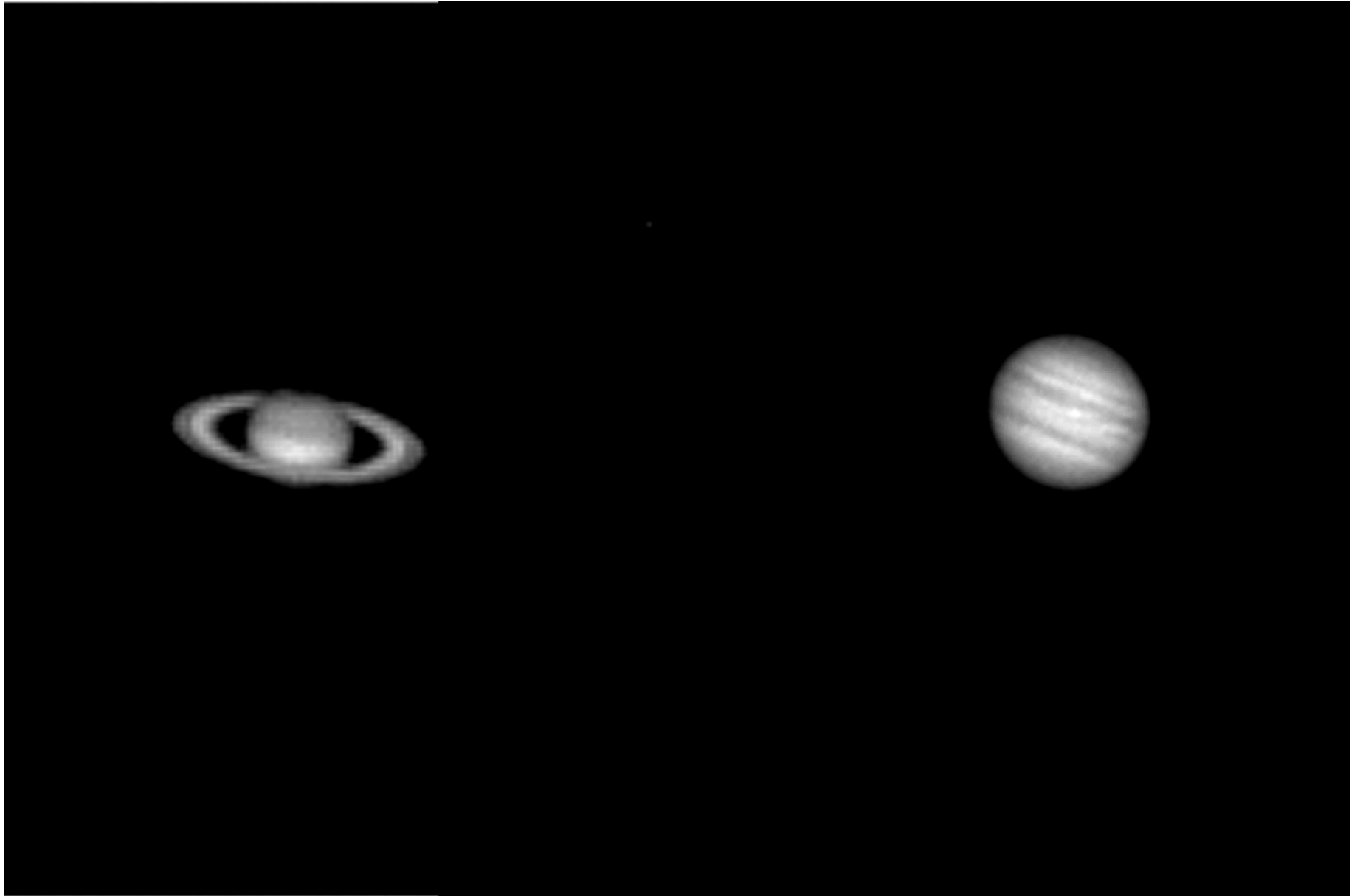


Saturn 8" SCT Projection 2 sec. Fujichrome 400

8/31/98 Eugene #20



8" Meade SCT Fuji M/S 200 Eugene, 9/15/98



1st CCD Images 8" Meade SCT; ST5c; Eugene 10/29/99

PHOTO-ENHANCEMENT

Scanning-Digital Format

Picture It

Adobe 5.0

Picture Window Pro 2.5

ETHICS

Limit Enhancements !

Minor Adjustments Only :

Contrast - Brightness - Richness - Sharpen

“TAKE A BETTER IMAGE”

TAKE GOOD NOTES

EXPERIMENT

HAVE FUN