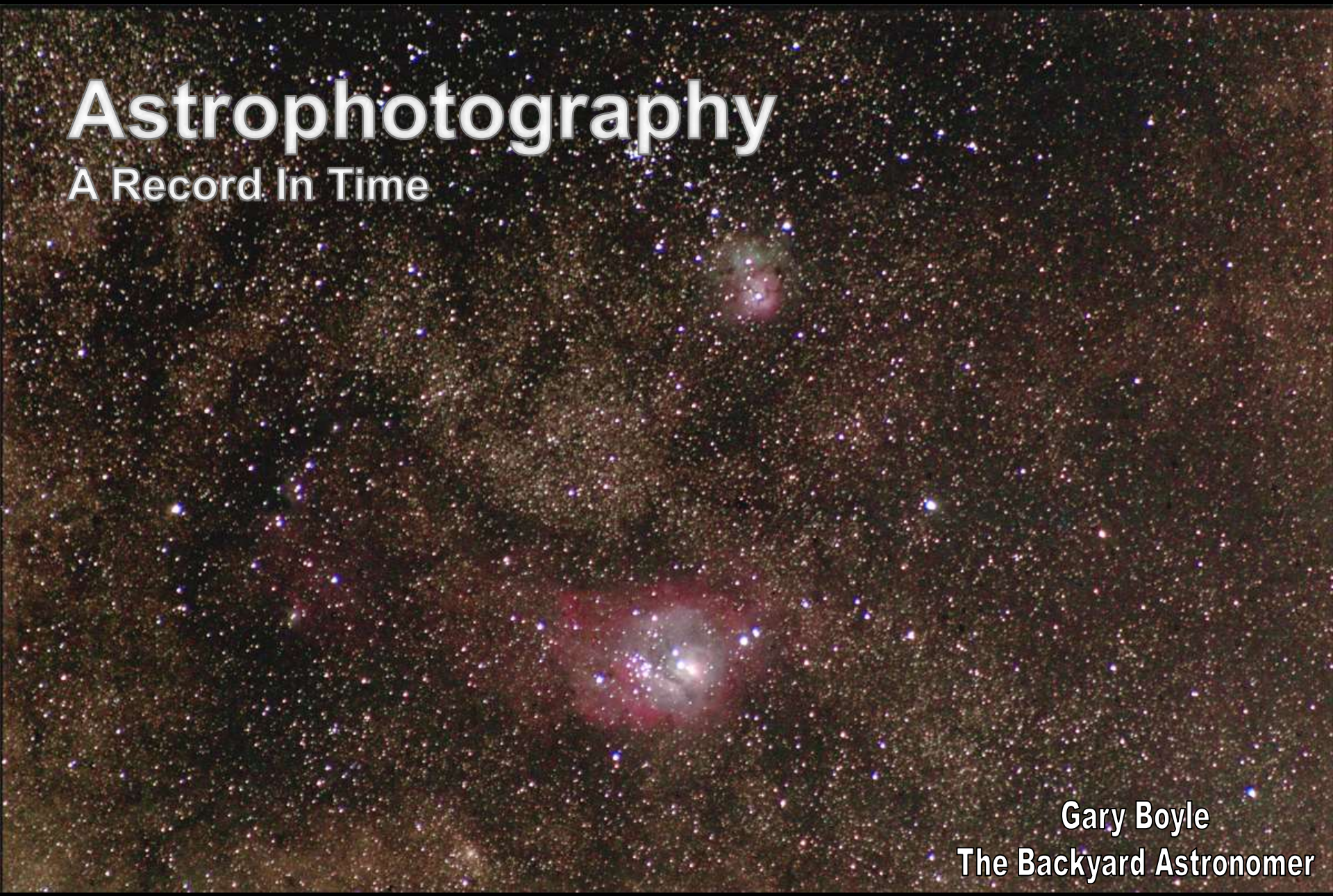
Lecture series #11
Astrophotography


Astrophotography
A Record In Time
Gary Boyle
The Backyard Astronomer


mario john borgatti© 2011

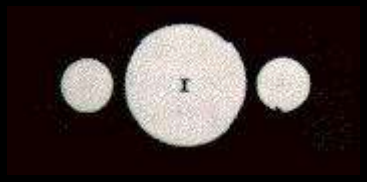
28000 BC

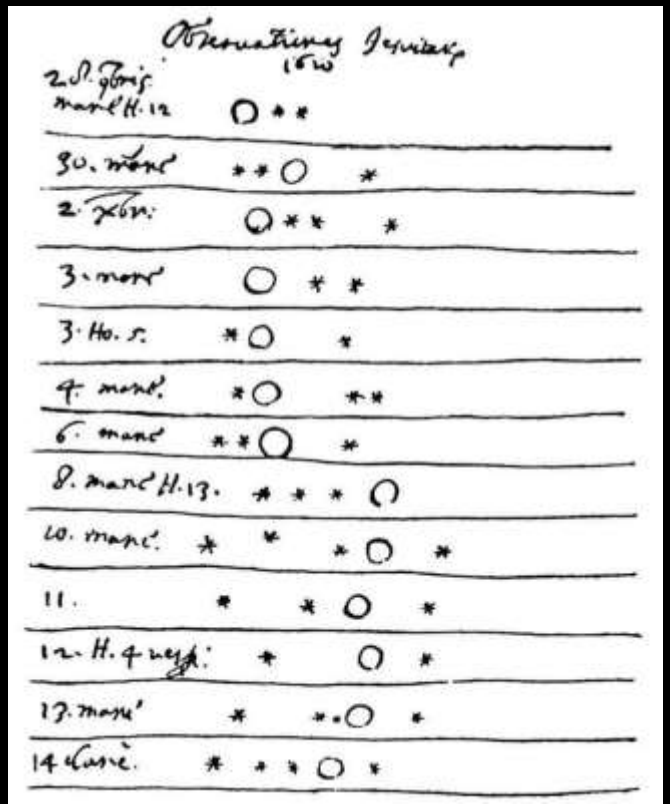
1608

Hans Lippershey

1609

Galileo Galilei





Great Plague of London 1665-1666

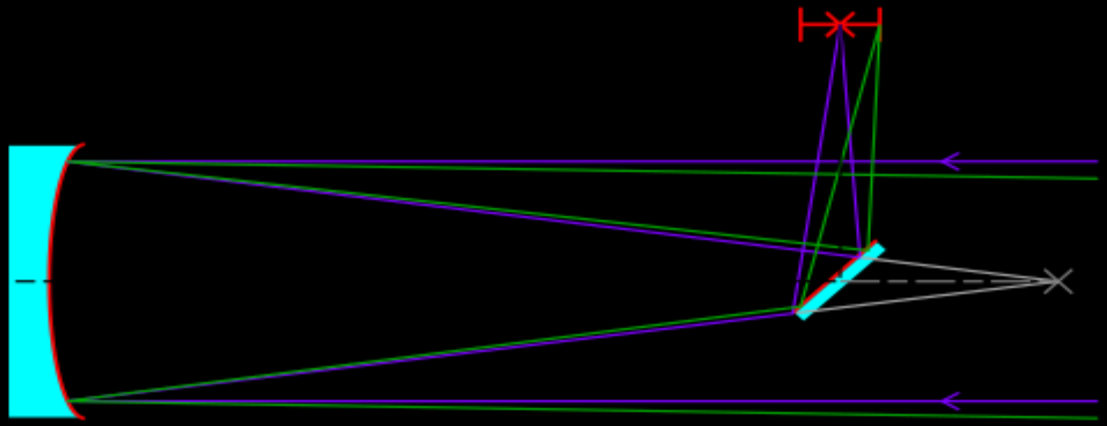
Sir Isaac Newton Discovers:

- Universal Law of Gravitation (falling apple)
- The Laws of Motion
- Developed Calculus to explain planetary motion

He laid the foundation on which science is being built today.

Red
Orange
Yellow
Green
Blue
Indigo
Violet

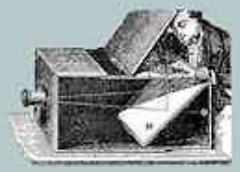
1668



Leonids 1833

Van Gogh – Starry Night

History of Photography



Camera Obscura invented
1021:

World's first photograph
1826:

Wet emulsion plates, collondion process
1851:

Kodak sells first commercial camera
1888:

Polaroid introduces first instant camera
1948:

First professional digital camera
1991:

1685:
First portable camera

1831:
Daggueerreotype process is created

1871:
Richard Maddox invents dry plates

1939:
WWII shapes new syle of photography

1977:
Konica releases the compact camera

2000:
First cell phone with camera

Joseph Nicéphore Niépce in 1826
Took 8 hours

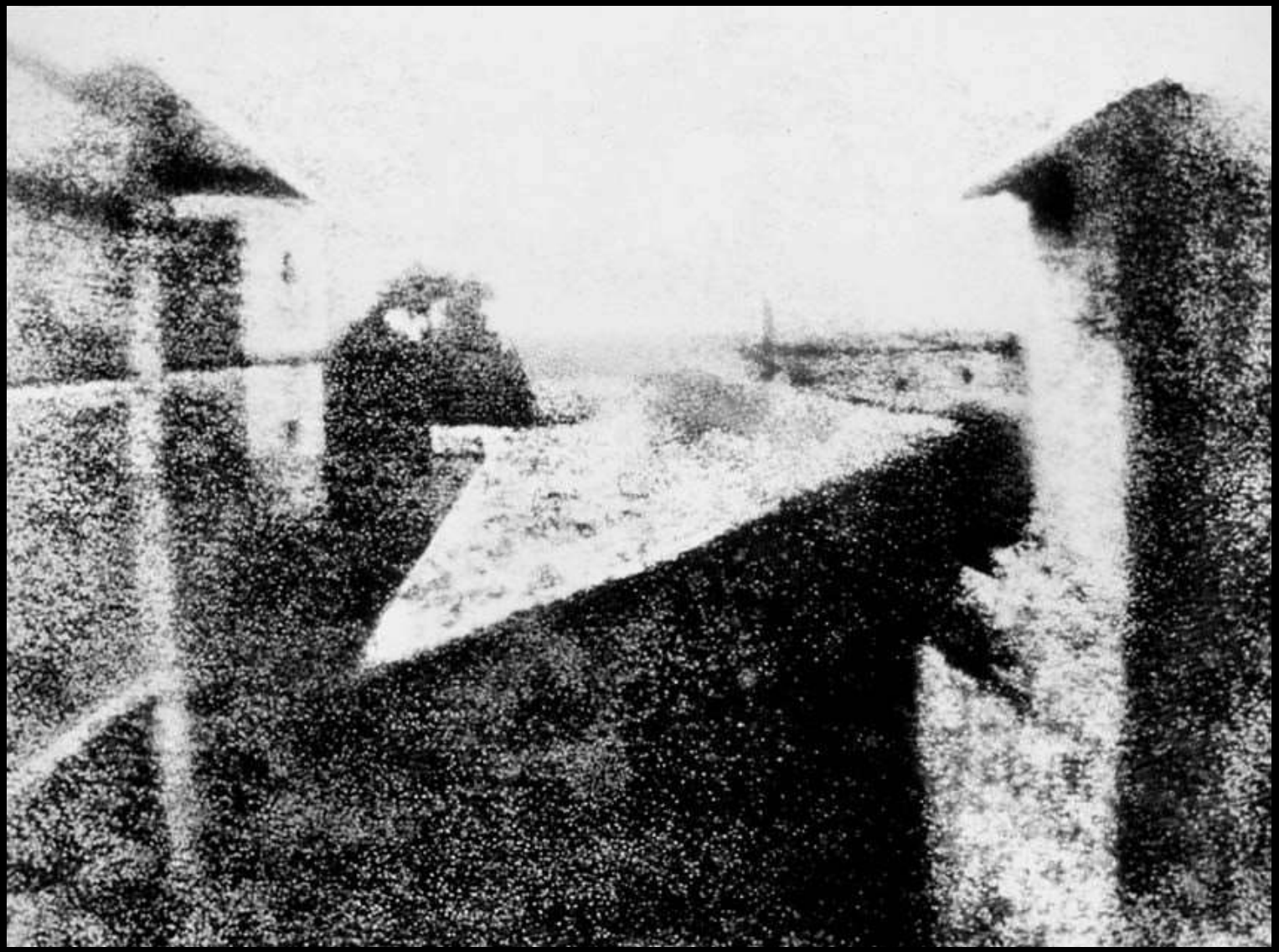
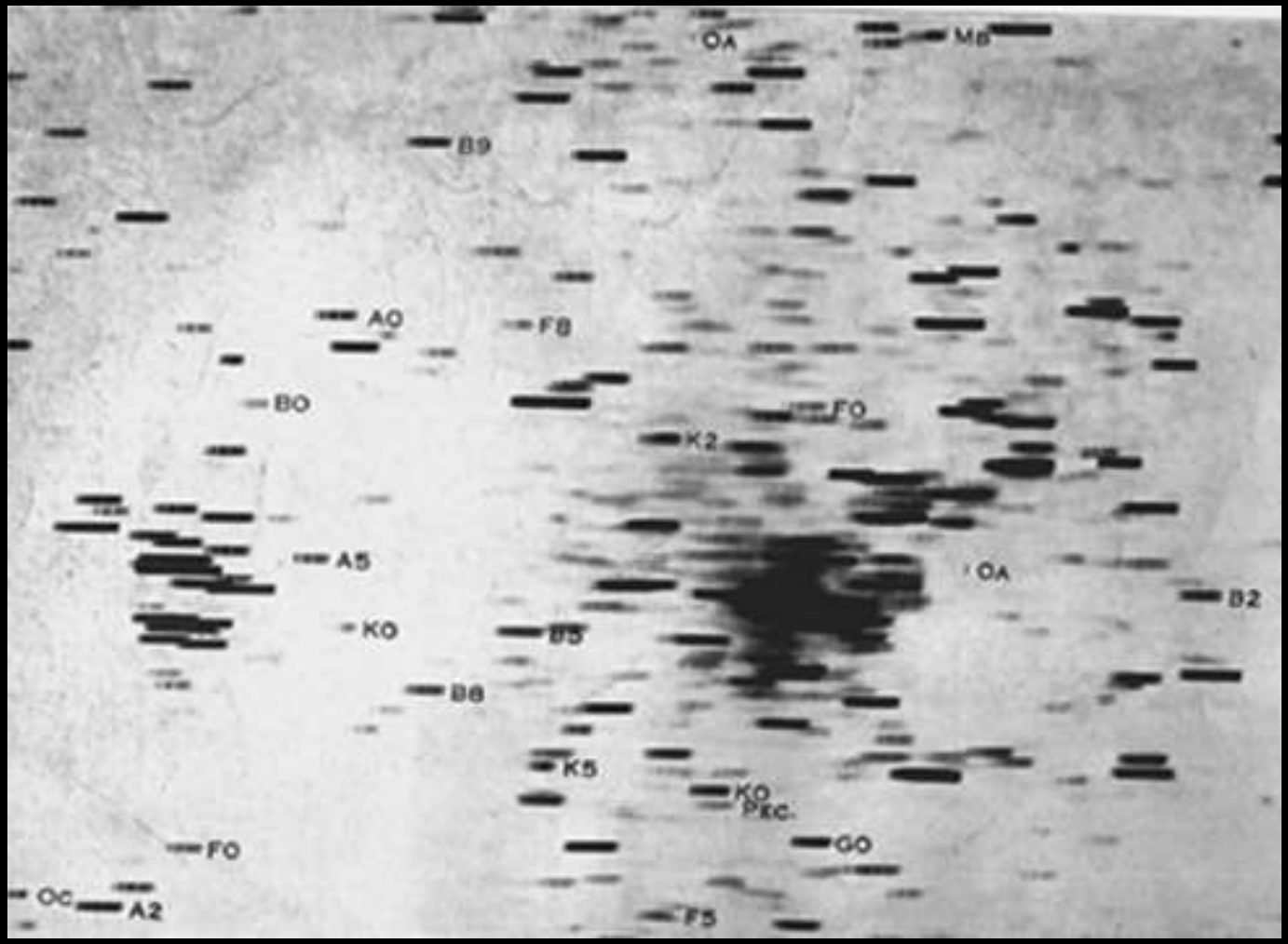


Photo Credit: Palomar Observatory

Annie Jump Canon

Harvard Computers
Edward Charles Pickering


OA
M6
B9
AO
F8
BO
FO
K2
A5
OA
B2
KO
B5
B8
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OC
A2
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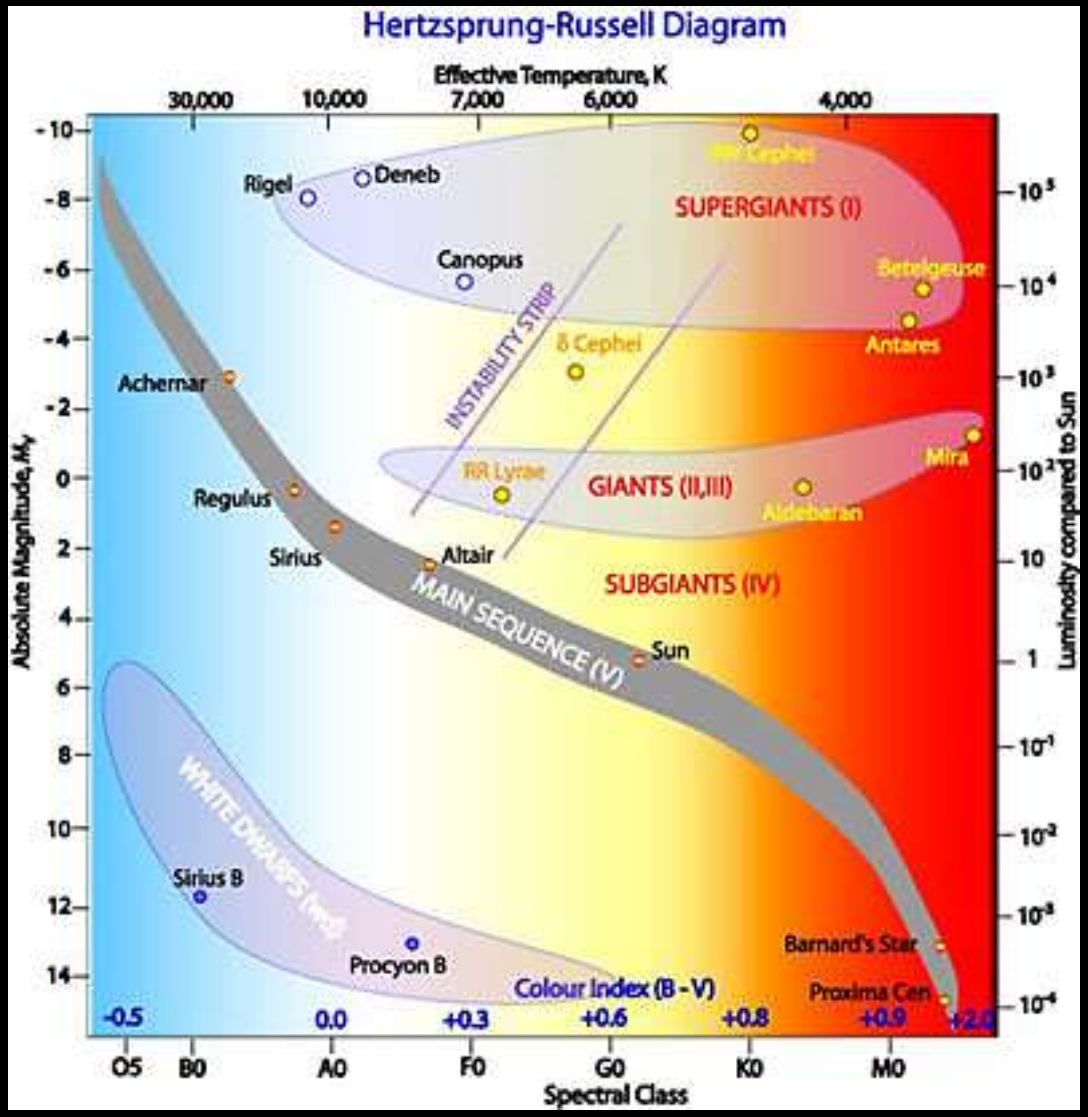
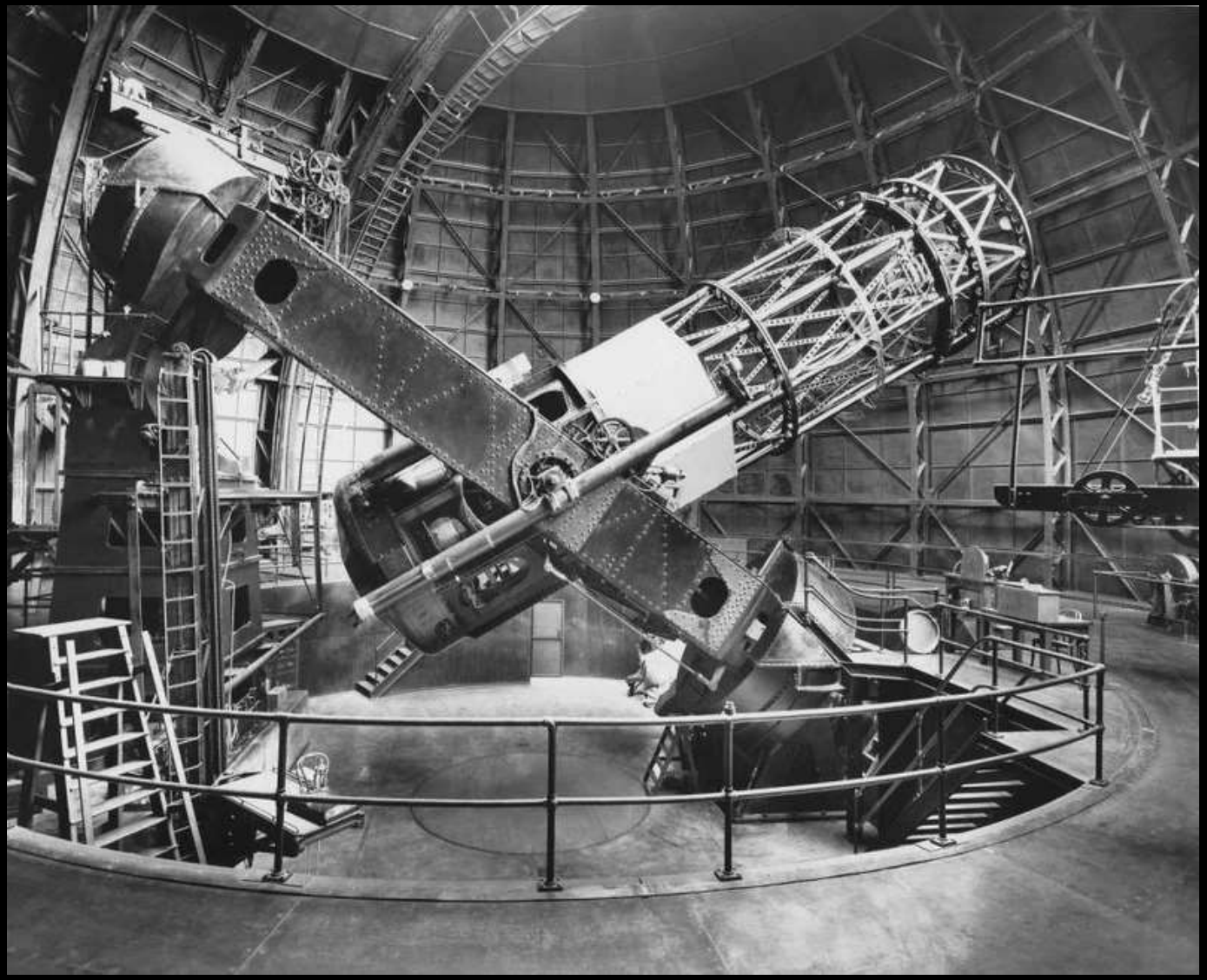
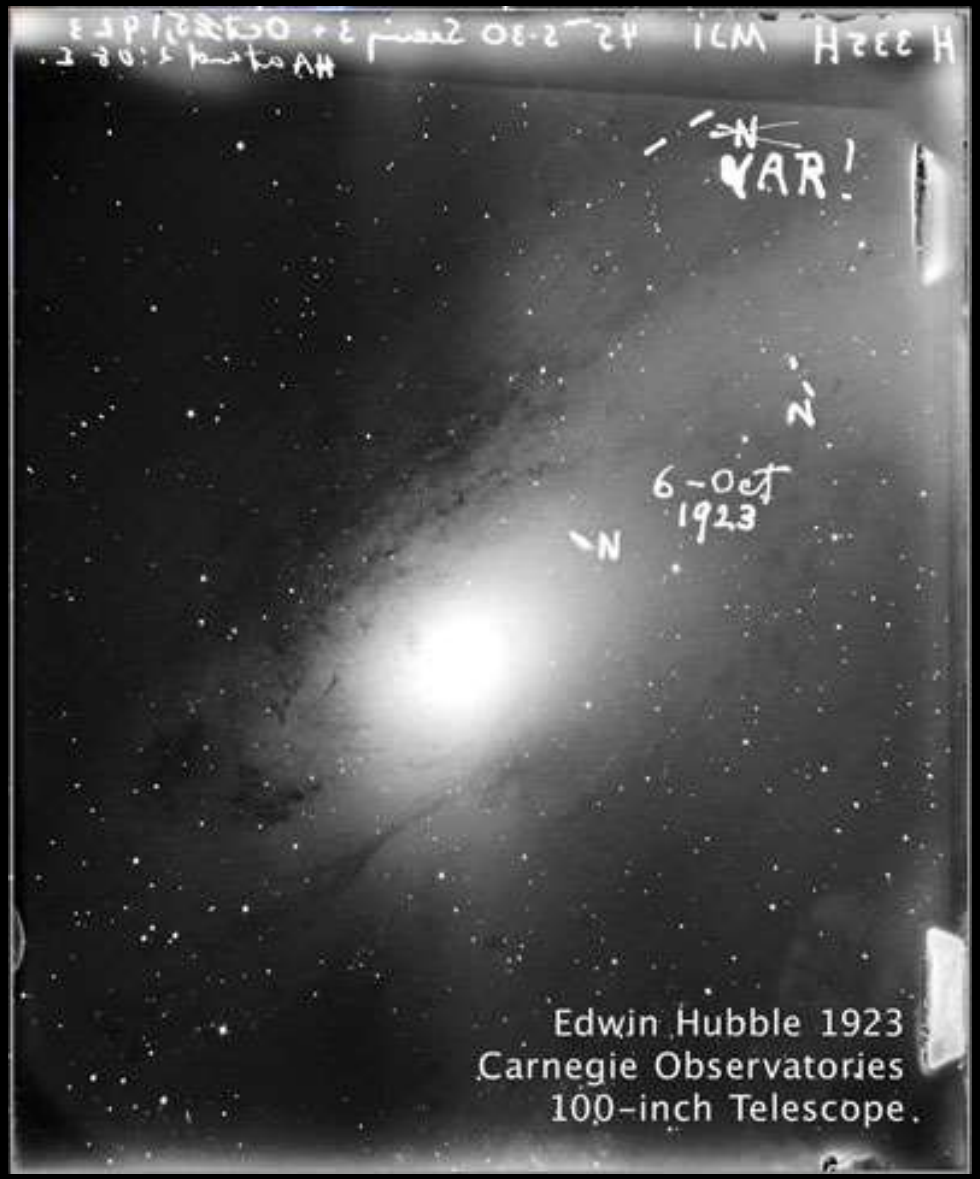

Hertzsprung-Russell Diagram
Effective Temperature, K
30,000
10,000
7,000
6,000
4,000
Absolute Magnitude, M_V
Luminosity compared to Sun
Rigel
Deneb
SUPERGIANTS (I)
Canopus
Betelgeuse
Antares
INSTABILITY STRIP
δ Cephei
Achernar
Mira
RR Lyrae
GIANTS (II,III)
Regulus
Aldebaran
Sirius
Altair
SUBGIANTS (IV)
MAIN SEQUENCE (V)
Sun
WHITE DWARFS (IV)
Sirius B
Procyon B
Barnard's Star
Proxima Cen
Colour Index (B - V)
-0.5
0.0
+0.3
+0.6
+0.8
+0.9
O5
B0
A0
F0
G0
K0
M0
Spectral Class

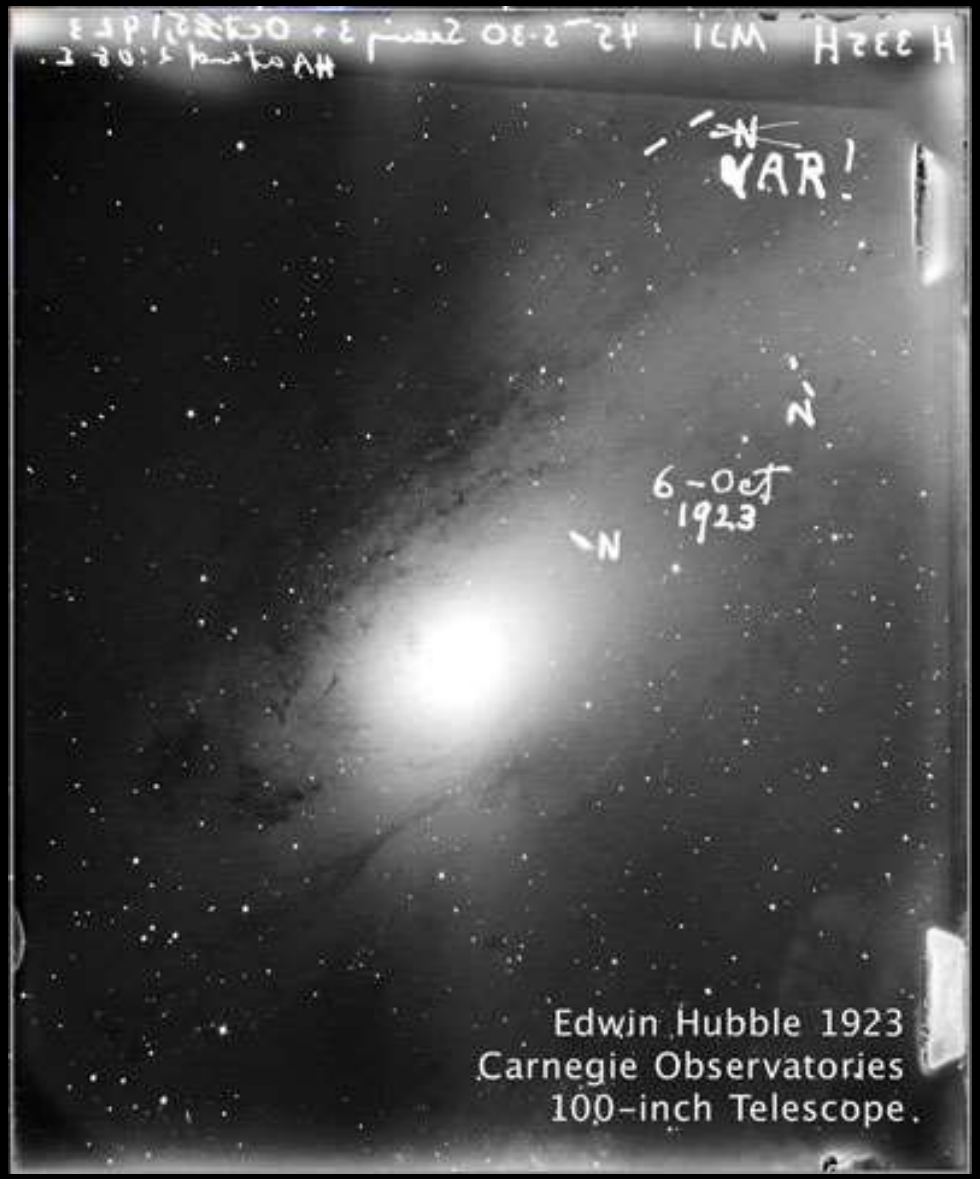
Estimated 350,000 stars

100-inch Hooker Telescope



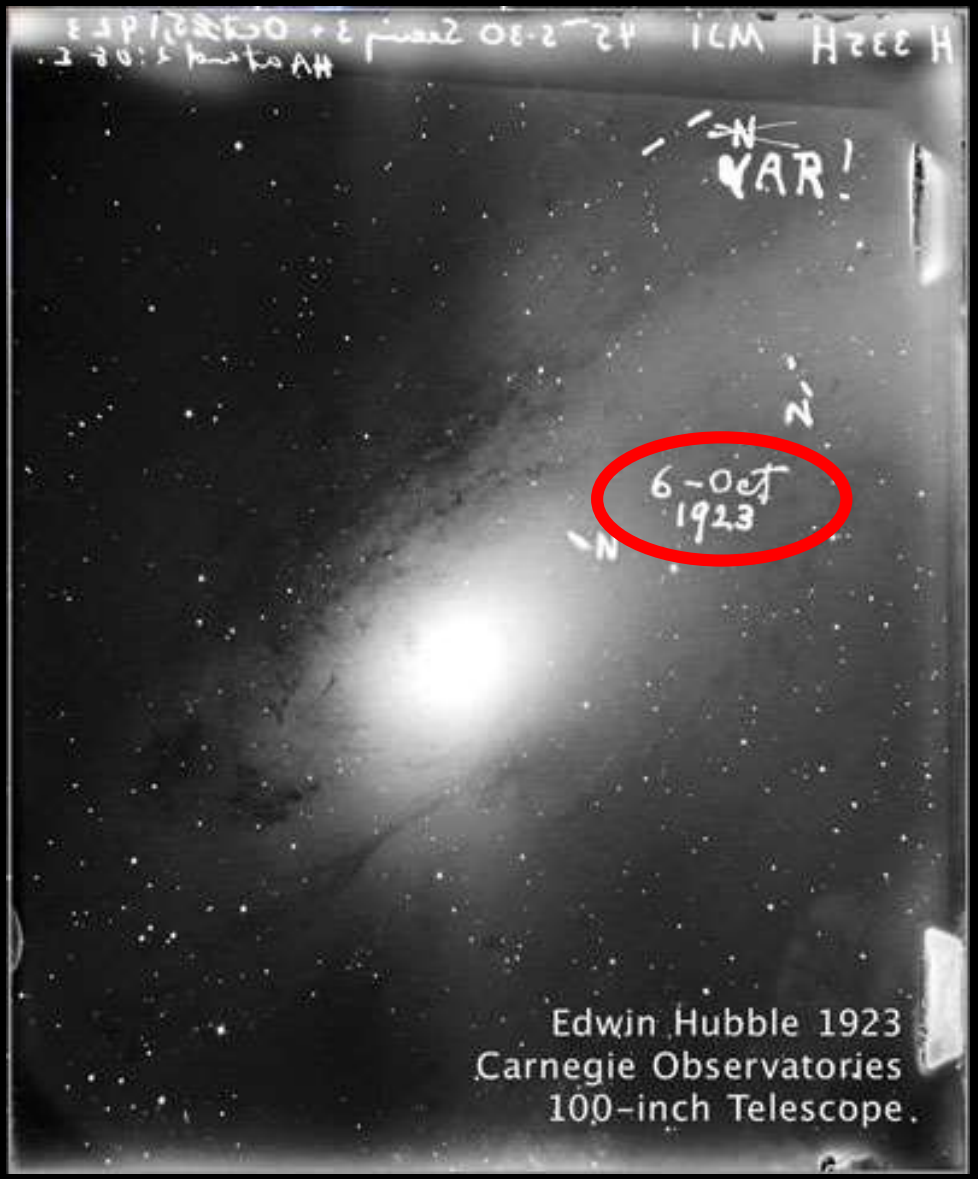

VAR!
N
N
6-Oct
1923
Edwin Hubble 1923
Carnegie Observatories
100-inch Telescope.

Henrietta Swan Leavitt



Cepheid Variable

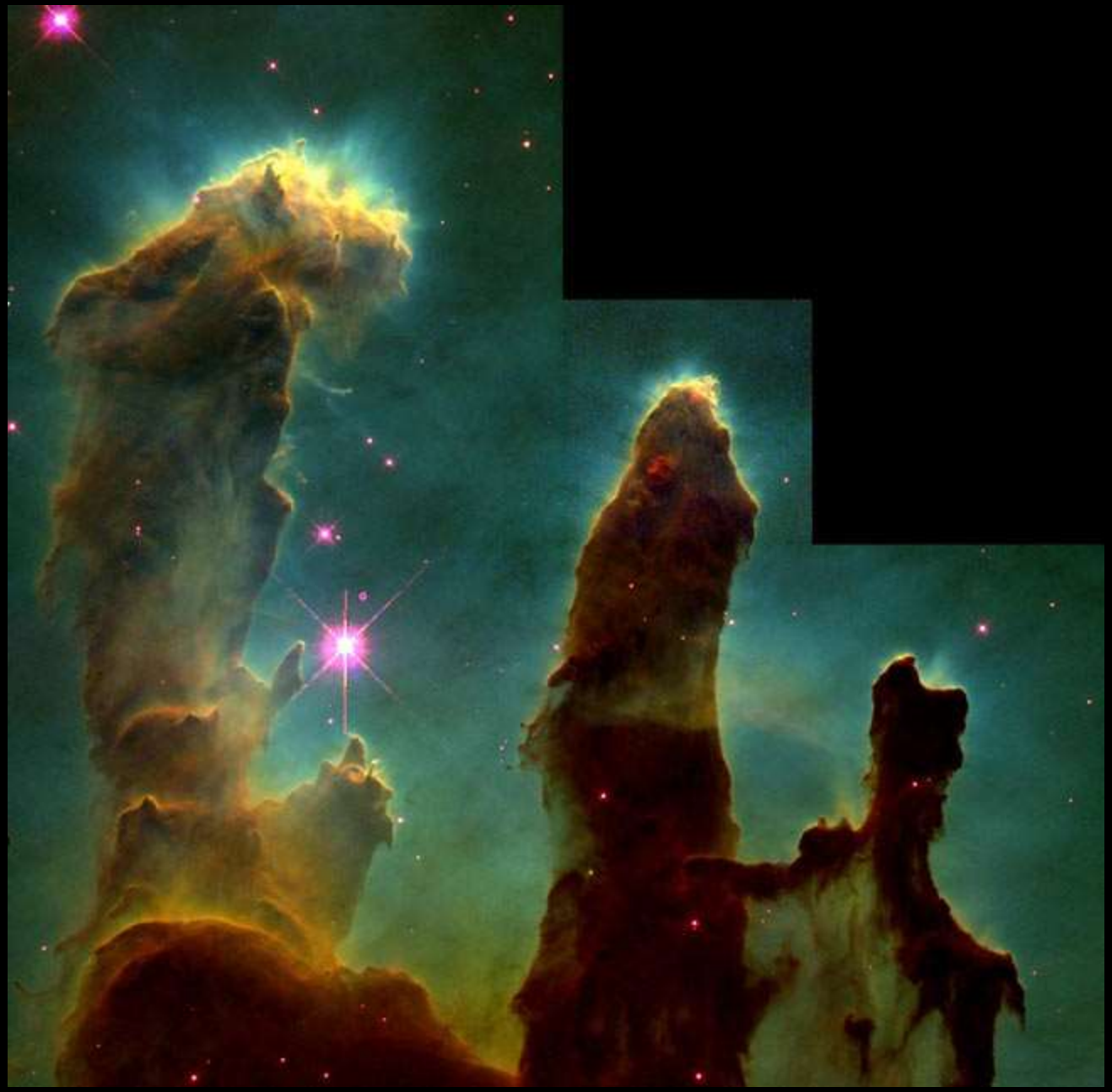
Henrietta Swan Leavitt

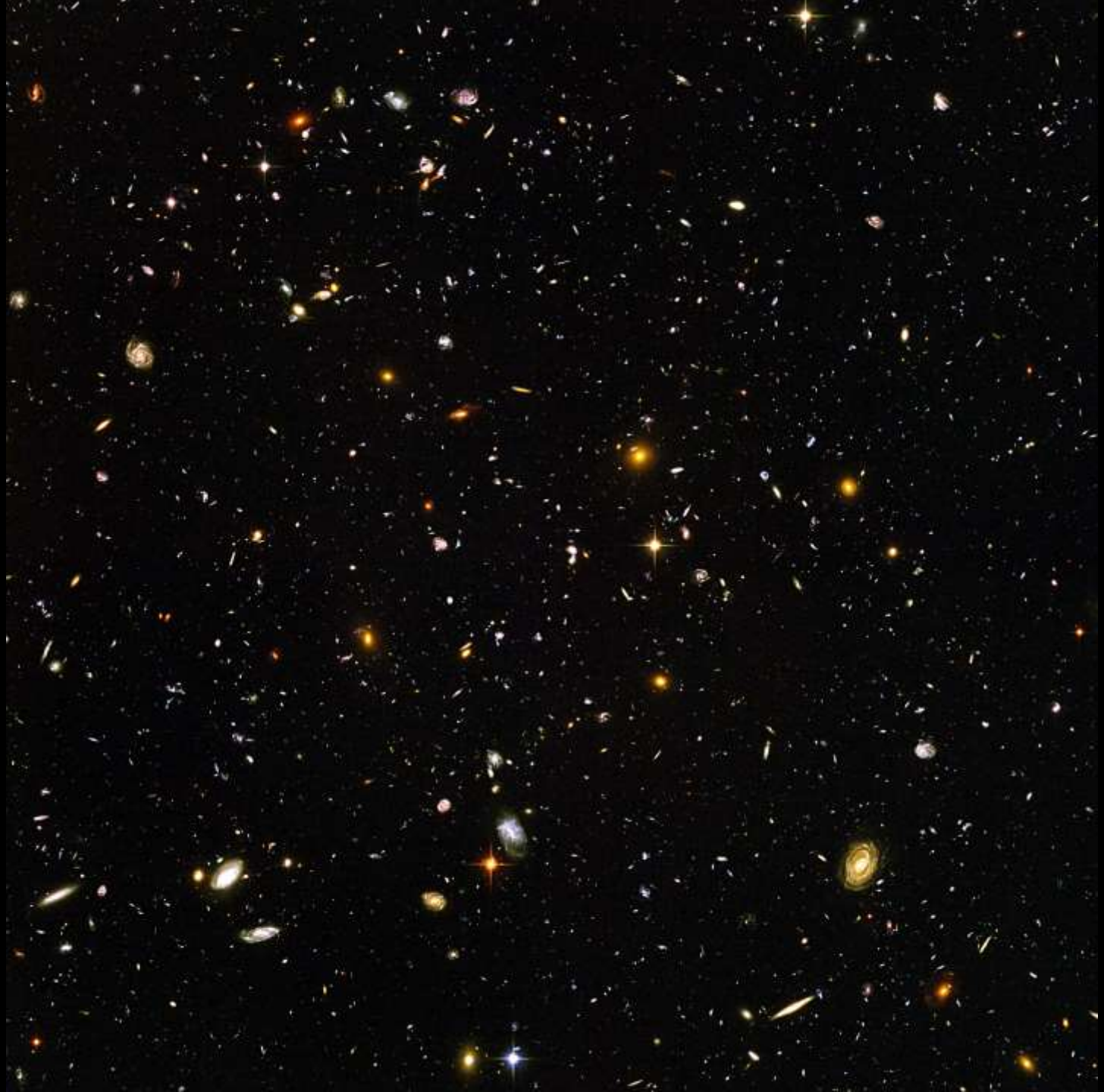


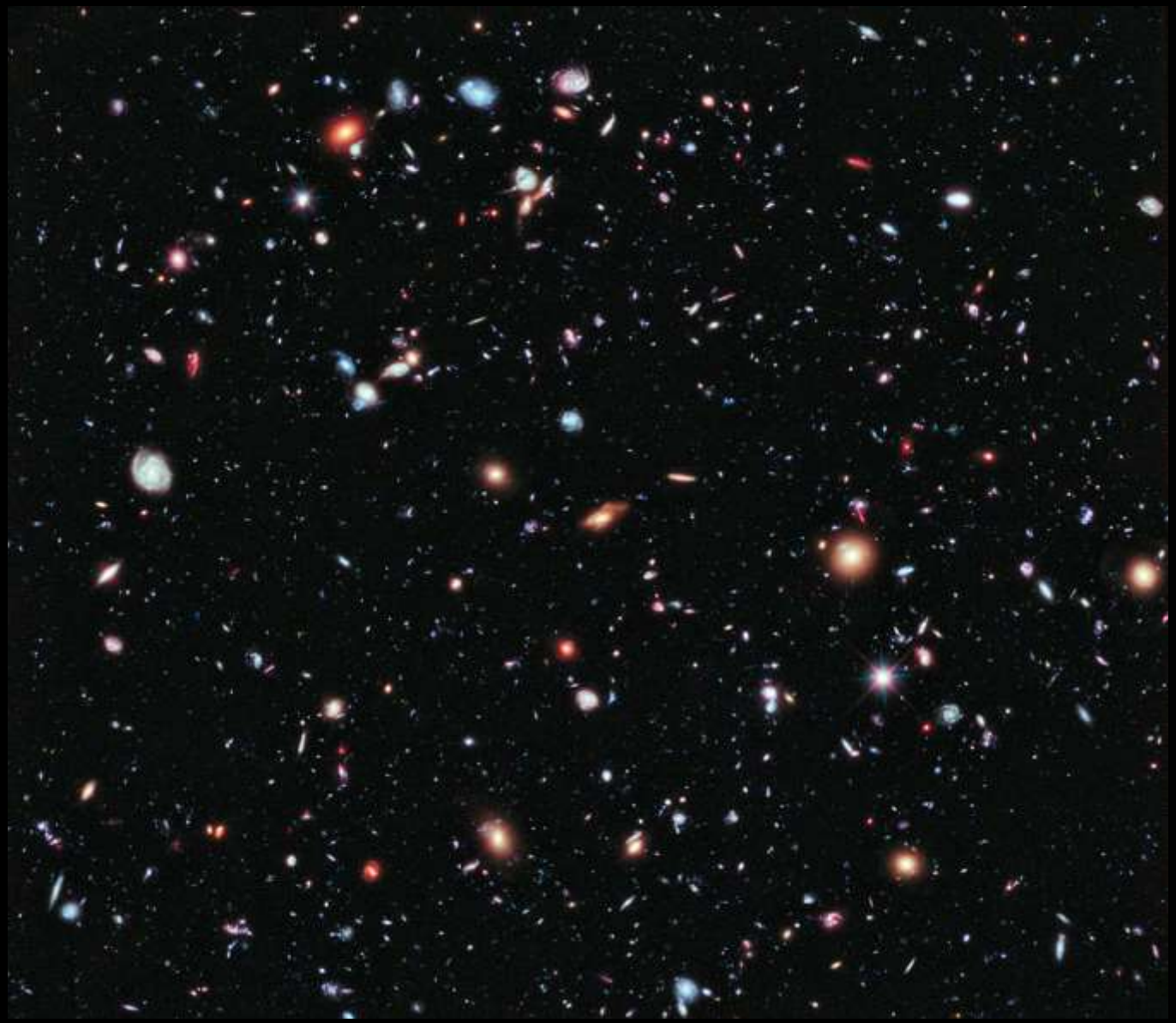
Cepheid Variable

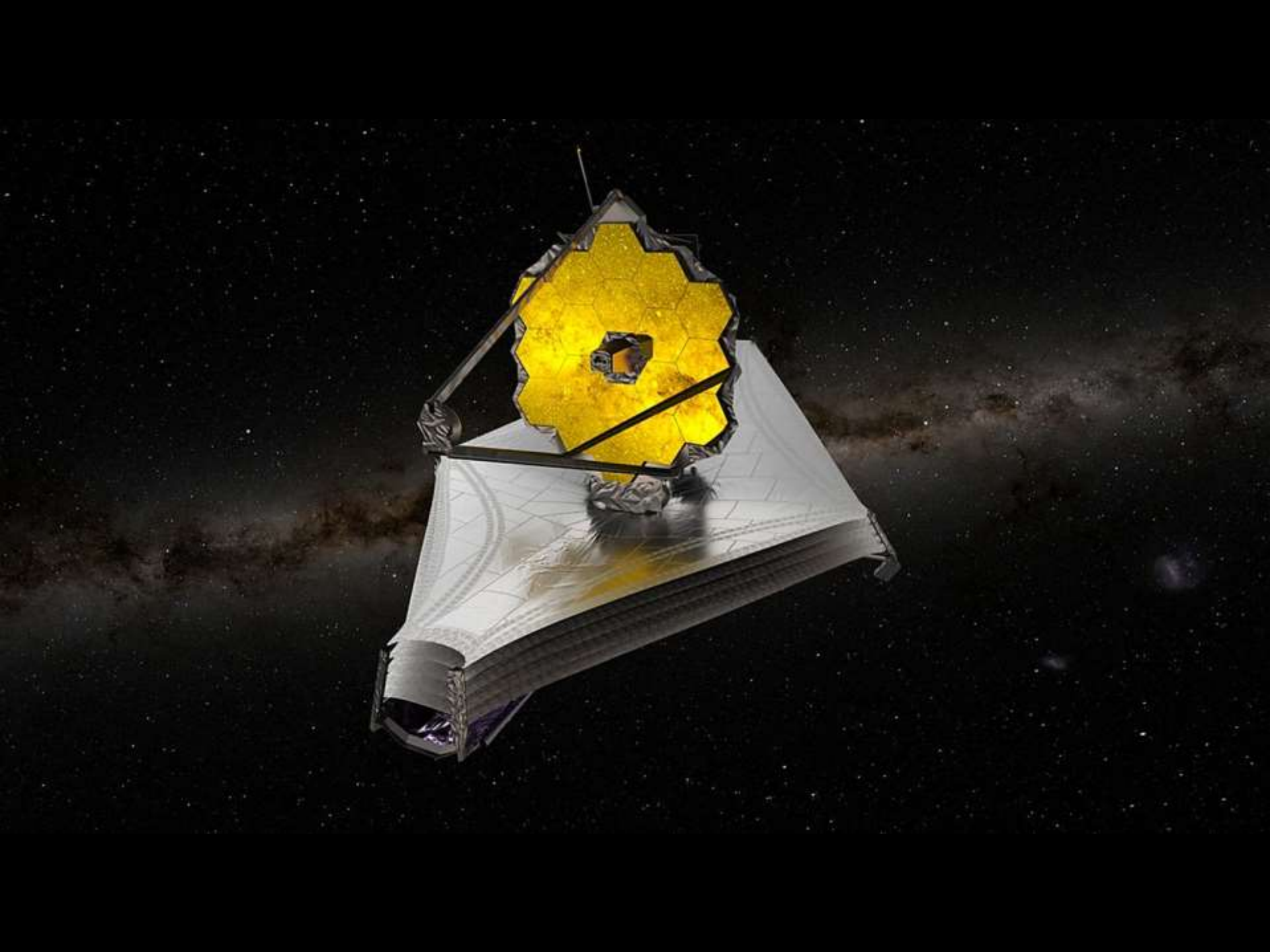
ANOTHER UNIVERSE SEEN BY ASTRONOMER

Dr. Hubble Describes Mass of Celestial Bodies 700,000 Light Years Away.

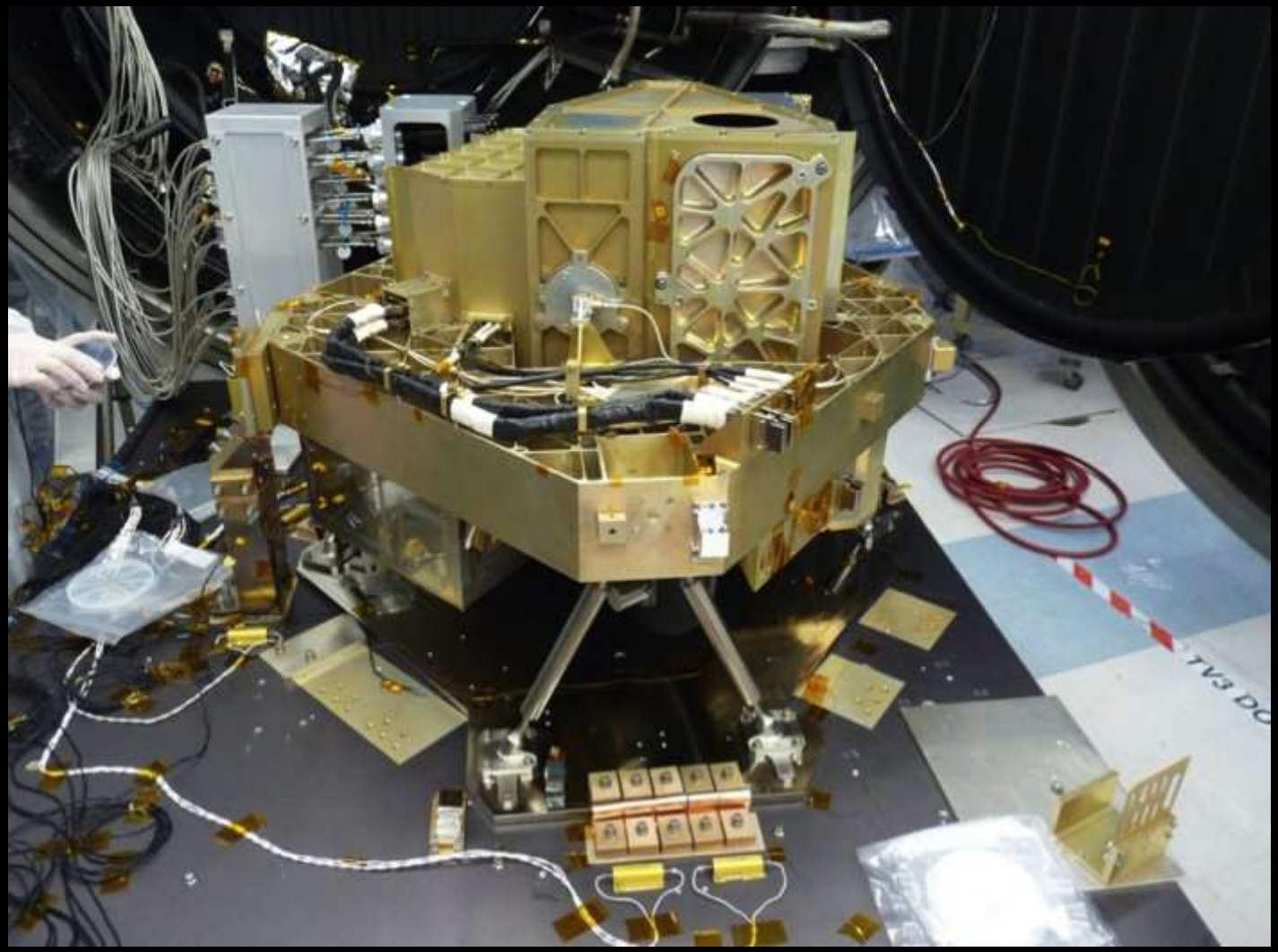




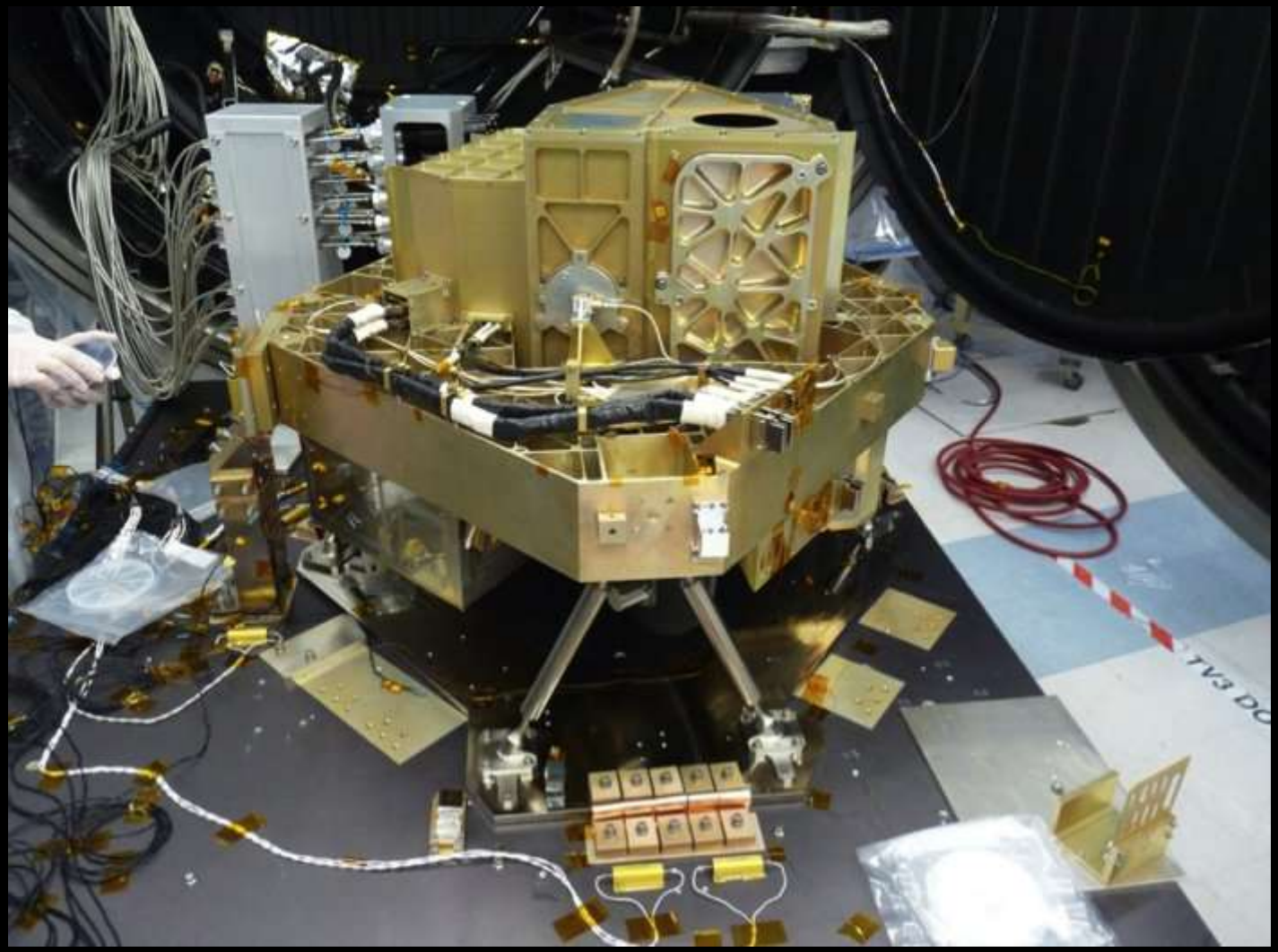




Fine Guidance, Near Infrared Imager, Slitless Spectrograph



Made in Ottawa




13.1 Billion Light Years Away

Photo: Gary Boyle

MOUNTS FOR SKY PHOTOGRAPHY

You don't need a telescope to take outstanding astrophotos. Some astrophotographers have galleries of hundreds of beautiful pictures of the Milky Way, comets, nebulas and star clusters and have not used a telescope to take any of them. Instead, they used a camera with a variety of lenses attached to a tracking mount. Of course, the mount could be one normally used to hold a telescope, but simple homemade tracking mounts, such as the ones seen on these two pages, are inexpensive to build and produce impressive results.

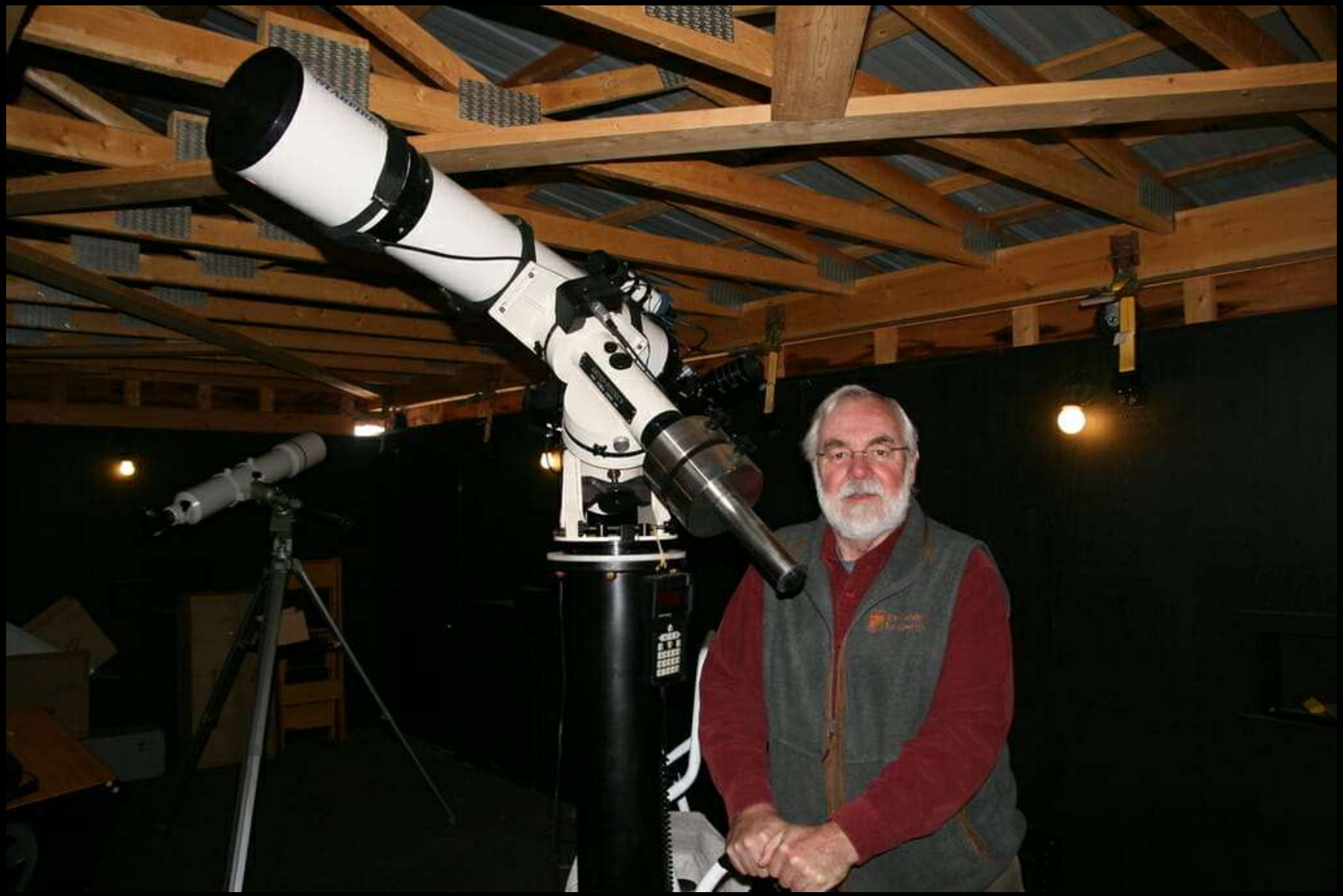
The outfit pictured at left, made by Gary Boyle of Ottawa, Ontario, may look unsophisticated at first but, in fact, is a very well-thought-out version of what has come to be known as the barn-door tracker. A more stripped-down edition of the barn-door tracker, by John Childs of Brockville, Ontario, is shown in the upper three photographs on facing page. Most people who see such a device say, either out loud or to themselves, "That can't possibly work." It not only works, but with the relatively short exposures needed with modern films, the barn-door tracker makes more sense now than ever before.

Today's superb high-speed films can yield a fully exposed astrophoto in less than five minutes with an f2.8 lens. And how good are the results? The photo of Comet Hale-Bopp on page 67 was taken using a barn-door tracker. Another example is the Milky Way shot at the top of page 75. If your appetite has been whetted by those pictures, you may want to give serious consideration to the barn-door tracker before

This camera tracker, built by Gary Boyle of Ottawa, Ontario, is a rugged unit that allows accurate polar alignment and precise tracking using a guidescope. The dual-hinge design integrates an accessory platform to hold a timer and batteries for the guidescope cross-hair illuminator.

Photo: Gary Boyle

Terence Dickinson
(1943 – 2023)

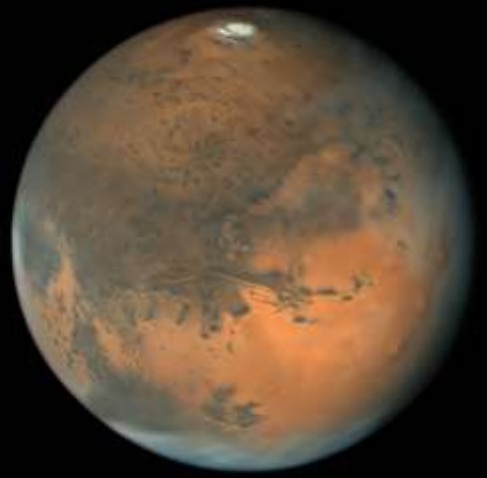


Alan Dyer

Photo: Alan Dyer

Composite Image

Photo: Alan Dyer



Photos: Damian Perch

Photo: Maple Guy

Prime Focus (telescope)

Photo: Gary Boyle

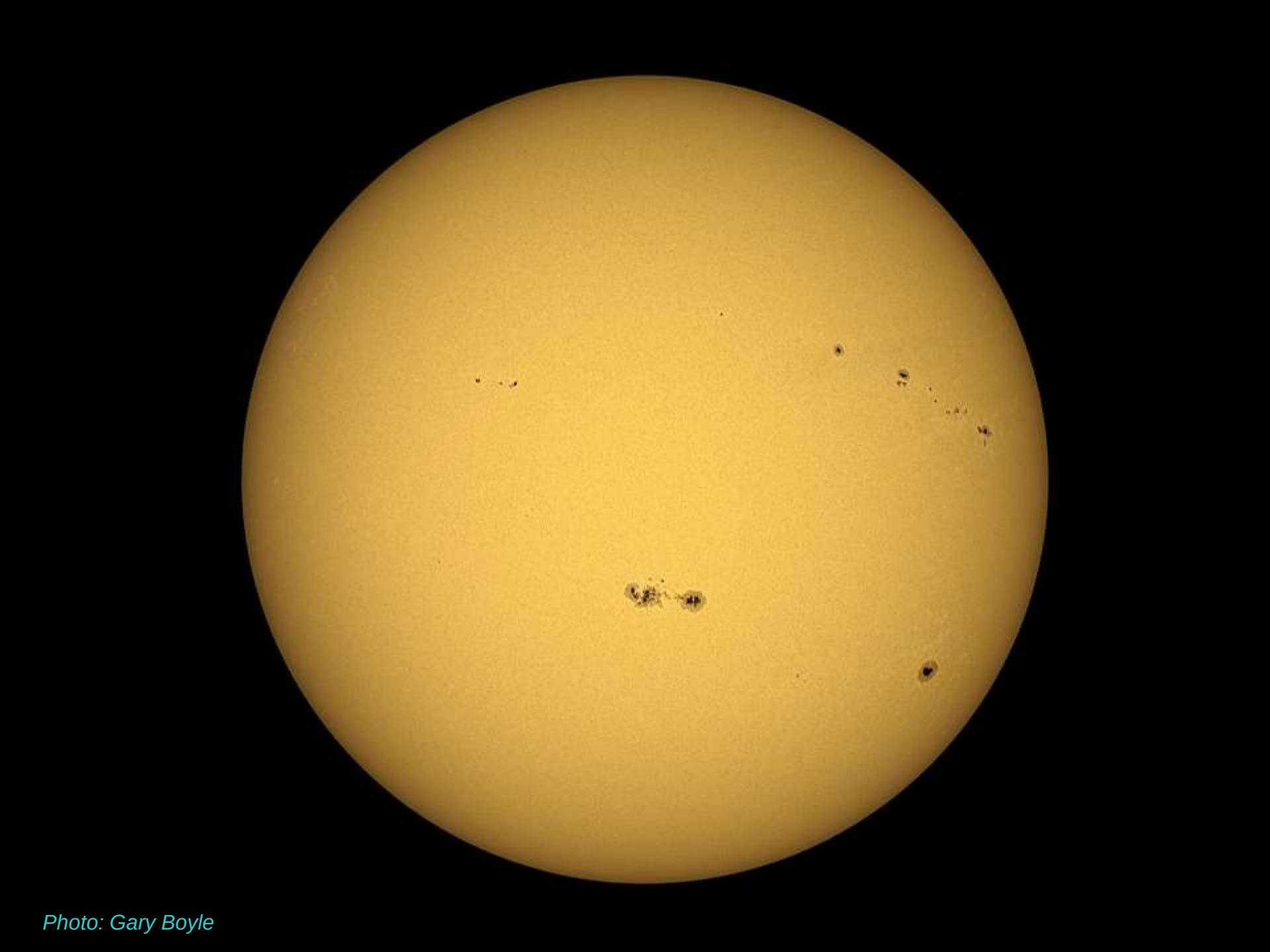


Photo: Gary Boyle

Canon 450 D
8” f/6 telescope (1219 mm)
ISO 100
Prime Focus
10 x 1/320 sec
Registax 5
PS Elements

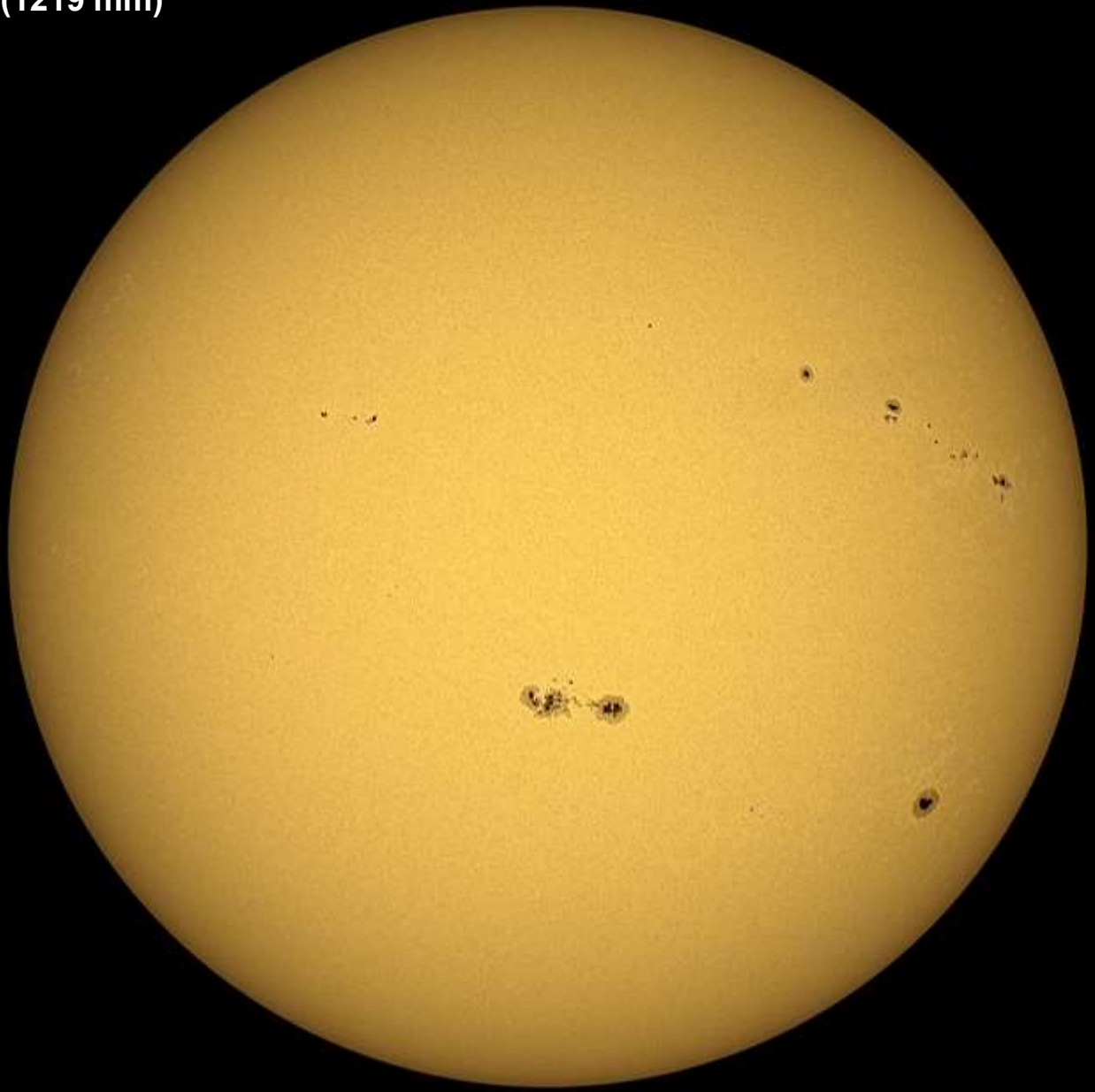


Photo: Gary Boyle


Canon 450 D
12” f/10 telescope (3048 mm)
ISO 100
Prime Focus
Focal reducer
1/250 sec
PS Elements
Photo: Gary Boyle

Tripods

Photo: Gary Boyle


Canon 450 D
300 mm
ISO 200
F/22
1/50 sec
PS Elements
Photo: Gary Boyle

Minolta
50 mm lens
Fujichrome 400
f/5.6
20 sec

Photo: Gary Boyle

Photo: Gary Boyle

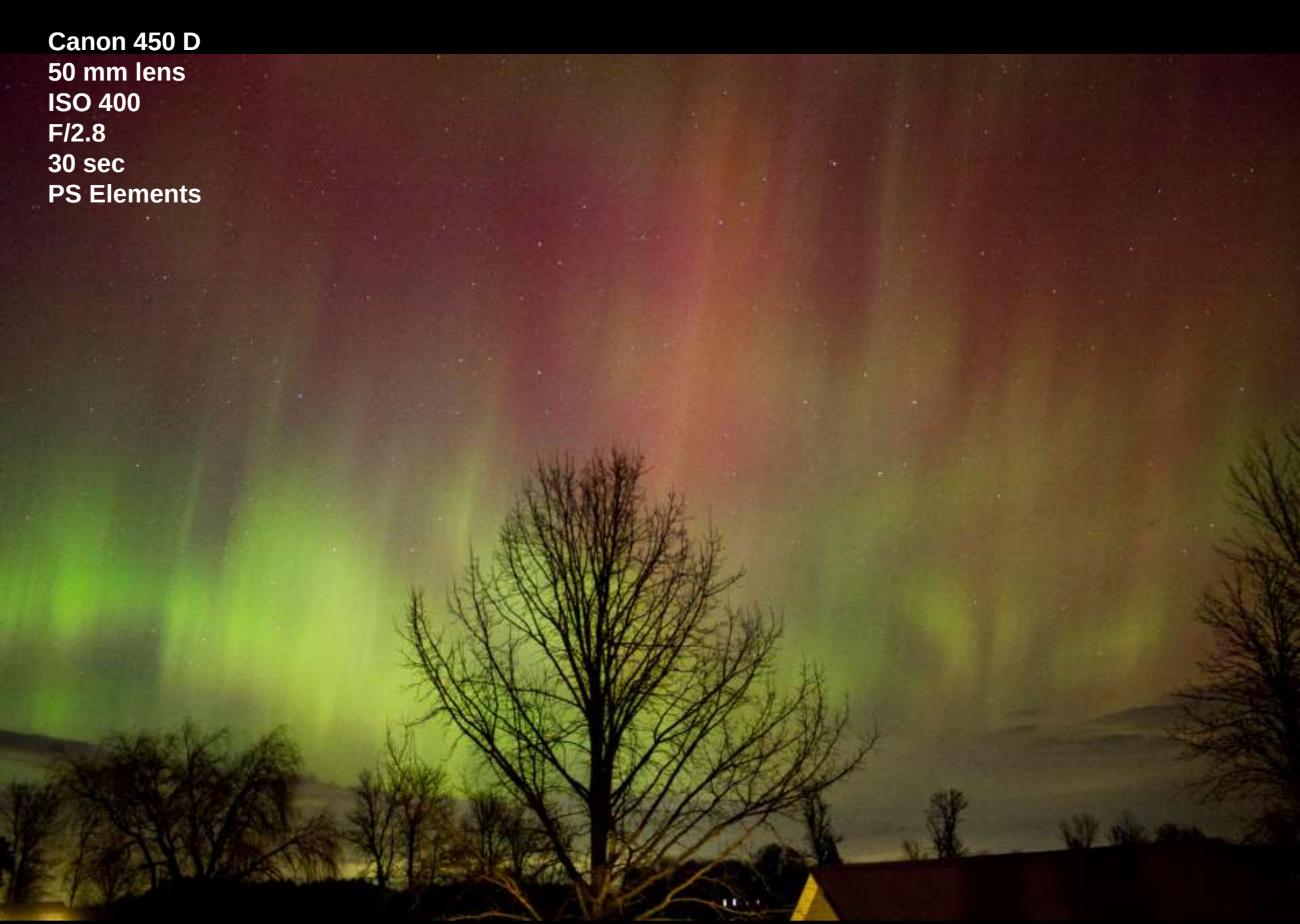


Photo: Gary Boyle

Photo: Gary Boyle

Photo: Gary Boyle

Photo: Gary Boyle


Photo: Pierre Martin

Photo: Gary Boyle

Photo: Gary Boyle

Video

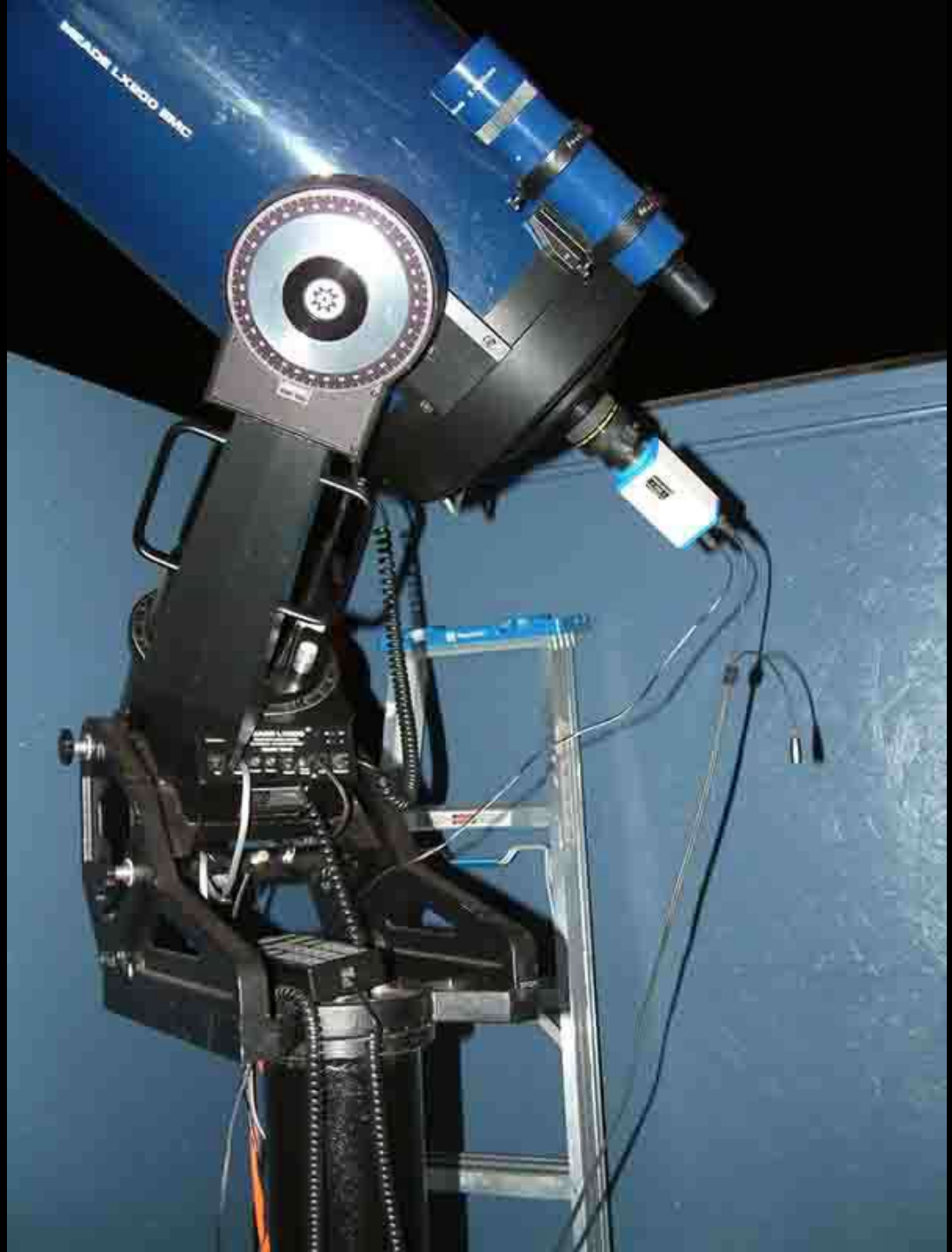


Photo: Gary Boyle

Photo: Gary Boyle

Photo: Gary Boyle

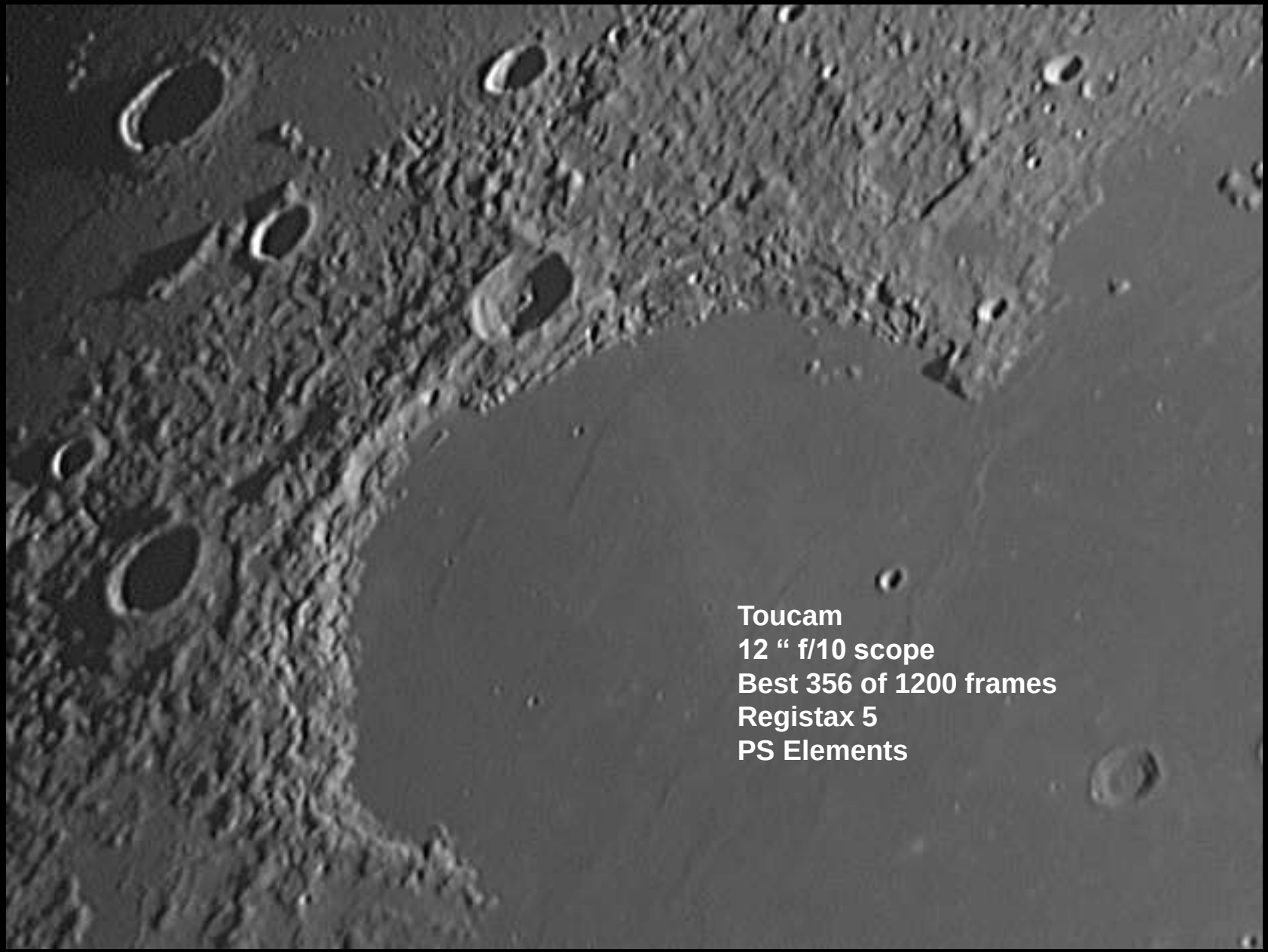
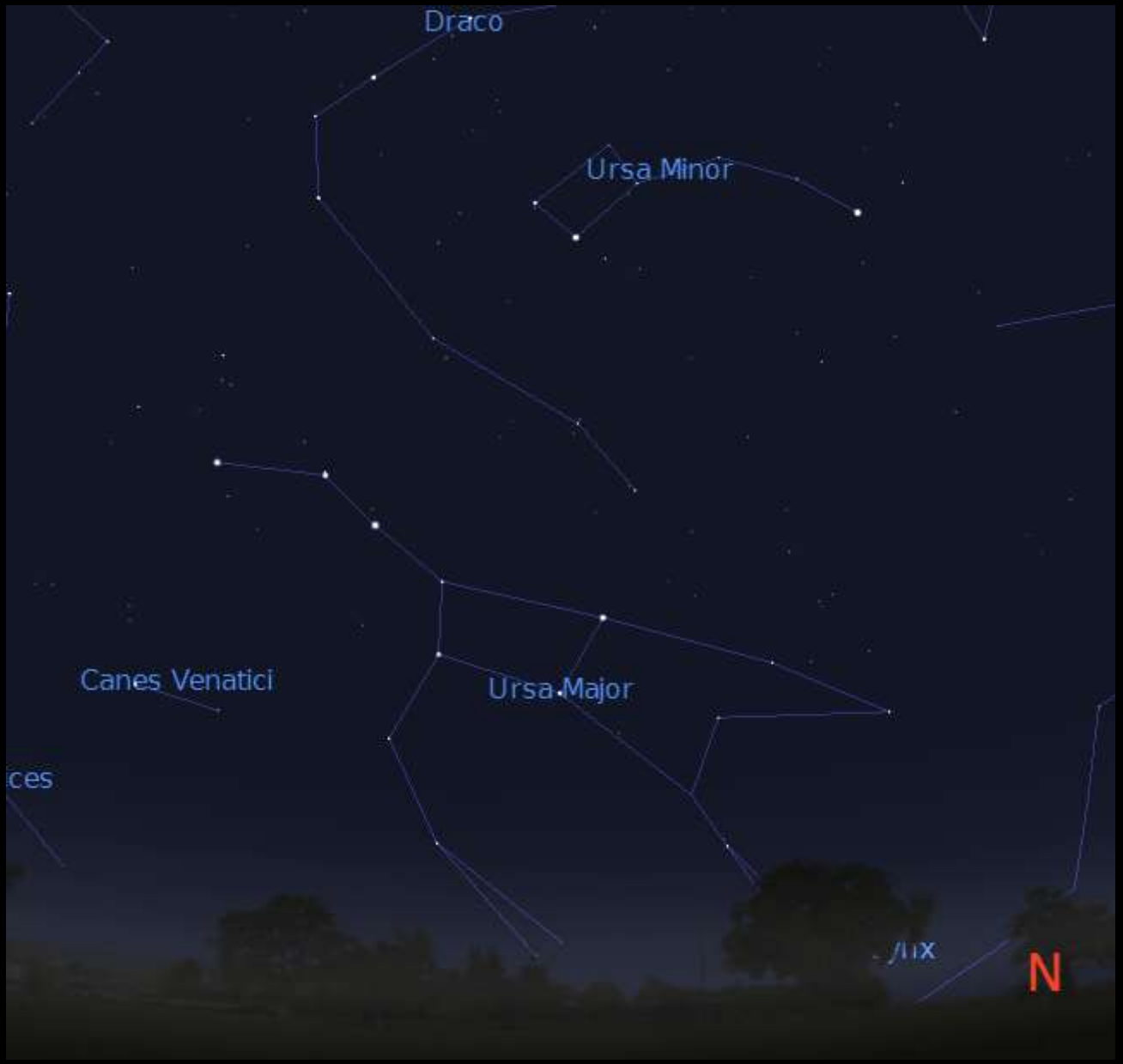


Photo: Gary Boyle

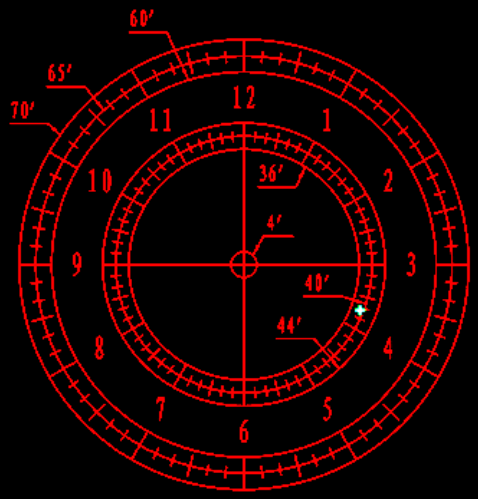
Photo: Gary Boyle

Photo: Gary Boyle


Draco
Ursa Minor
Canes Venatici
Ursa Major
ces
N

Local Time: 2022-08-09 10:51:40
Longitude: 075°26′09.24″ W 75.4359
Latitude: 44°57′37.80″ N 44.9605
Elevation: 0000 m
Temperature: 2.4 °C
Barometric Pressure: 100349 Pa
Position of Polaris: 03h 43.2m
Radius: 38.8 arcmin

English/简体中文



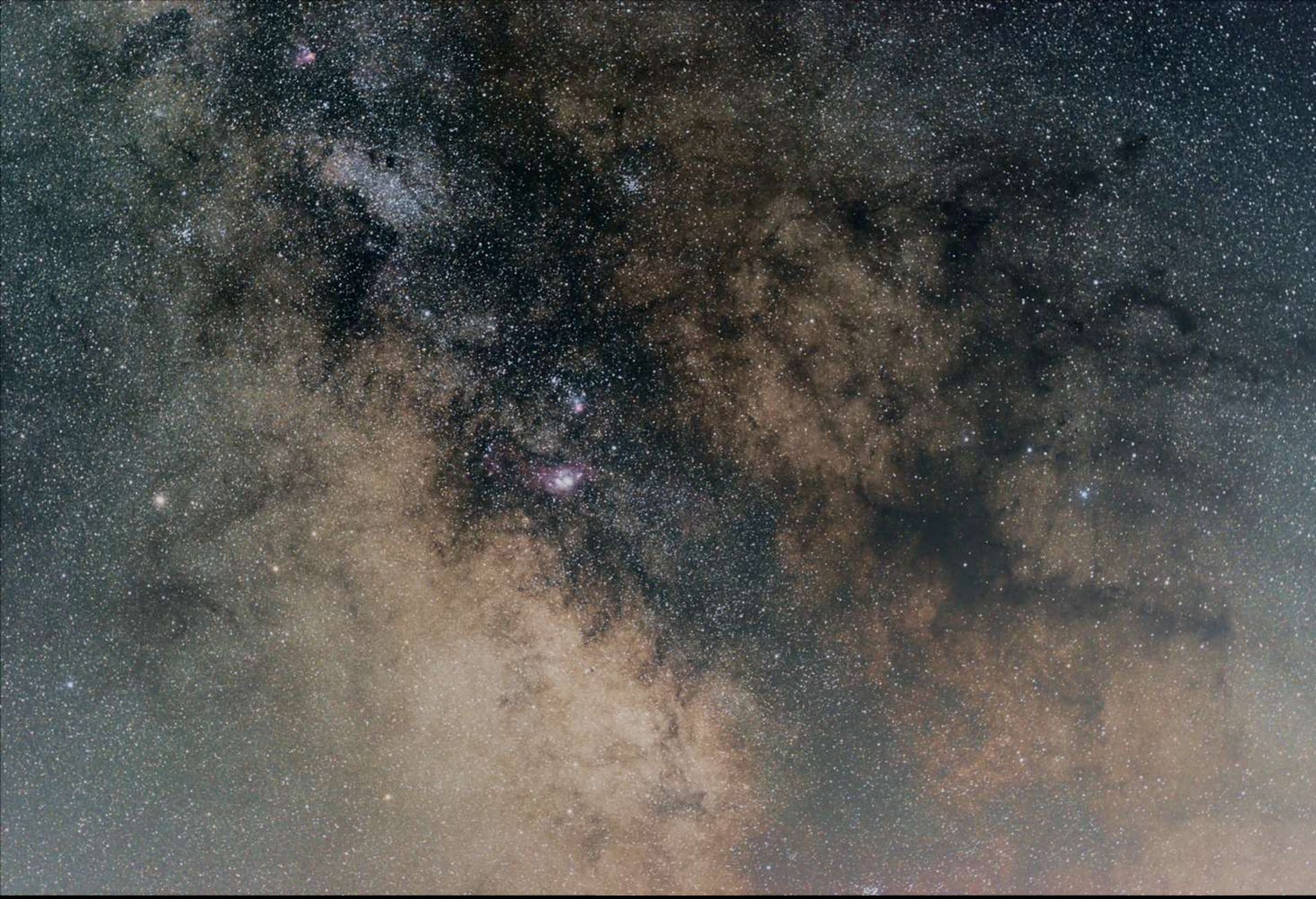


Photo: Gary Boyle

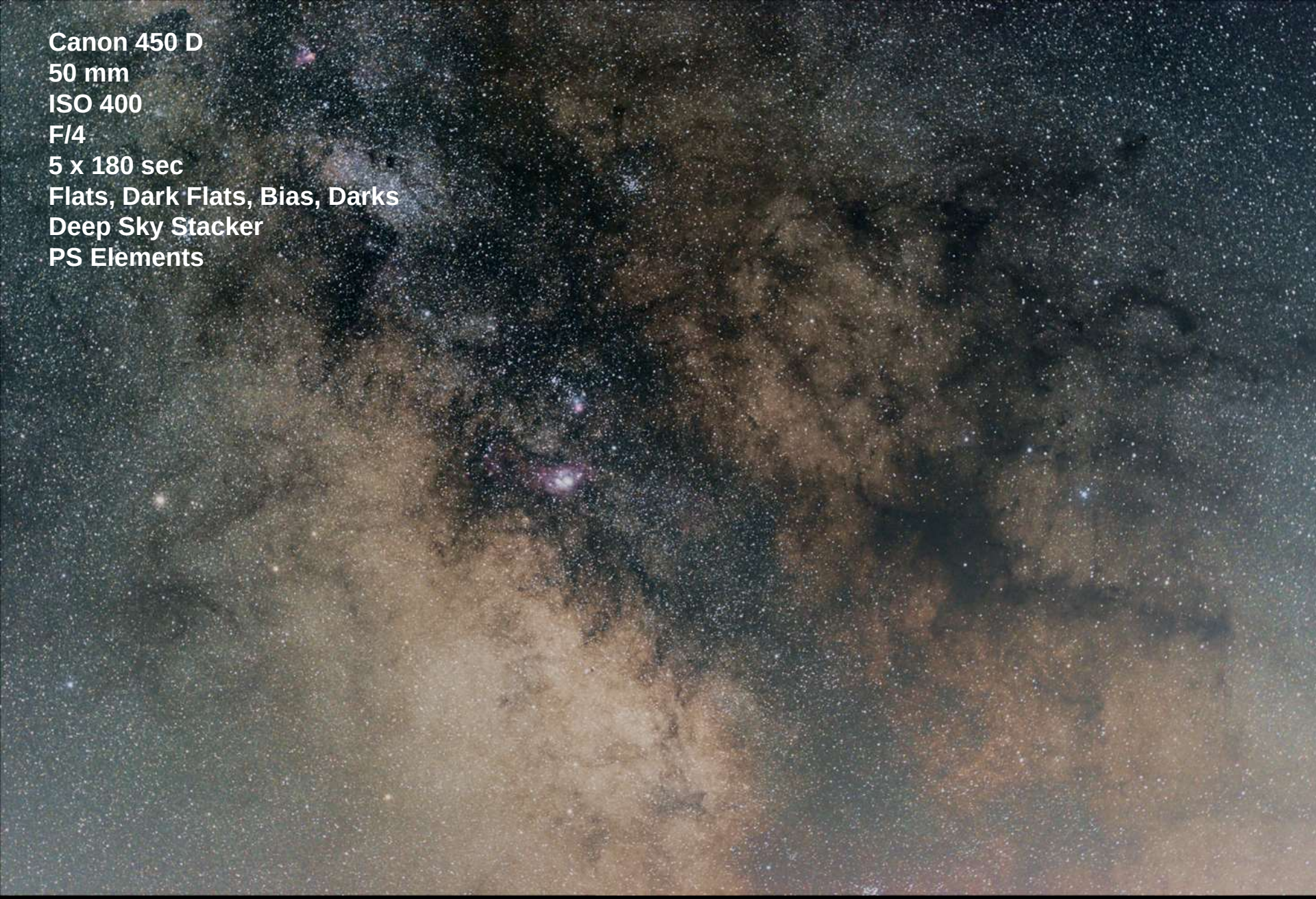


Photo: Gary Boyle

Photo: Gary Boyle


BROWNIE
Kodak
HAWKEYE
CAMERA


Kodak
film
FILM • DEVELOPING • FLASH BULBS
ONE DAY PHOTO FINISHING


minolta
XD11

Hyper sensitized film

Push processed $$$

Had to use the whole roll before switching film speed

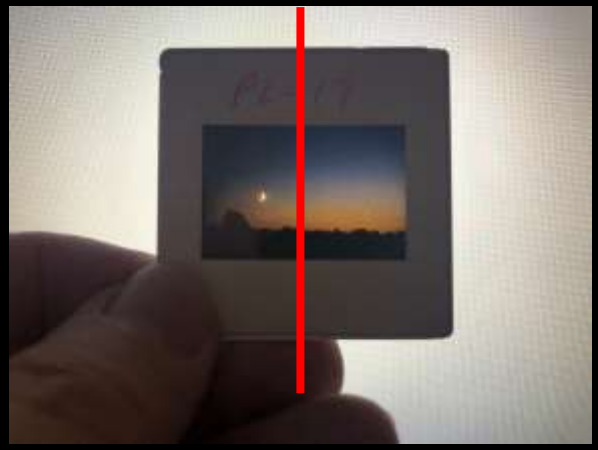
ASA to ISO in the 80s

Hyper sensitized film

Push processed $$$

Had to use the whole roll before switching film speed

ASA to ISO in the 80s




Nikon
COOLPIX
4500


Canon
EOS
CANON ZOOM LENS EF-S 18-55mm 1:3.5-5.6 IS
CANON INC.
Rebel XSi


Canon


No SIM
2:43 PM
Mail
Tuesday
26
Calendar
Photos
Camera
Maps
Clock
Weather
News
Home
Notes
Stocks
Reminders
TV
App Store
iBooks
appleinsider

31 Flavours

- Moon
- Planets
- Sun (safely)
- Double stars
- Galaxies
- Star clusters (open and globular)
- Nebulae (6 types)
- Lunar occultations
- Watching meteor showers
- Meteorites
- Comet hunting
- Astrophotography
- Image processing
- Supernova search (distant galaxies)
- Photograph Aurora Borealis (Northern Lights)
- Chasing solar eclipses
- Cosmology
- Rockets
- Variable star estimates

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- Sun (safely)
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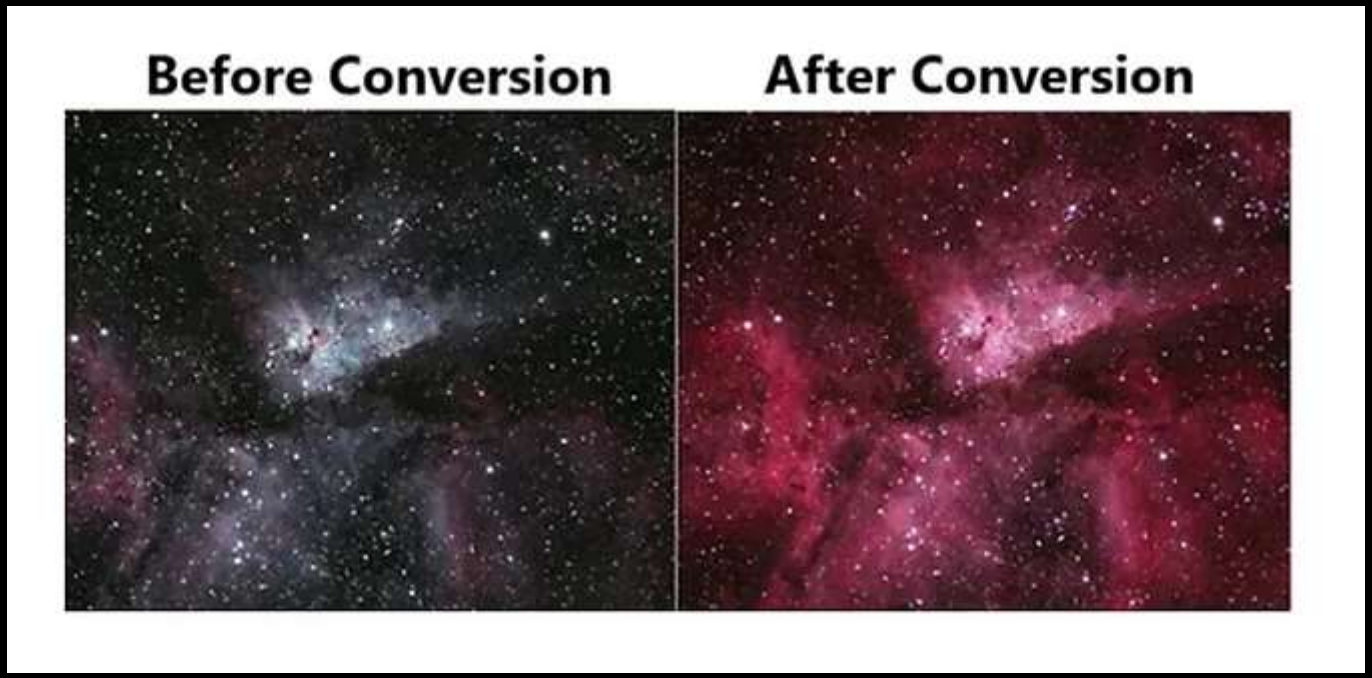
Photo: Gary Boyle


Before Conversion
After Conversion

Filters:
LRGB
Ha
OIII
Sulfur-II
Sulfur-III
Helium-II
Near Infrared

Photo: Joe Bonner

Post Processing

Photo: Joe Bonner

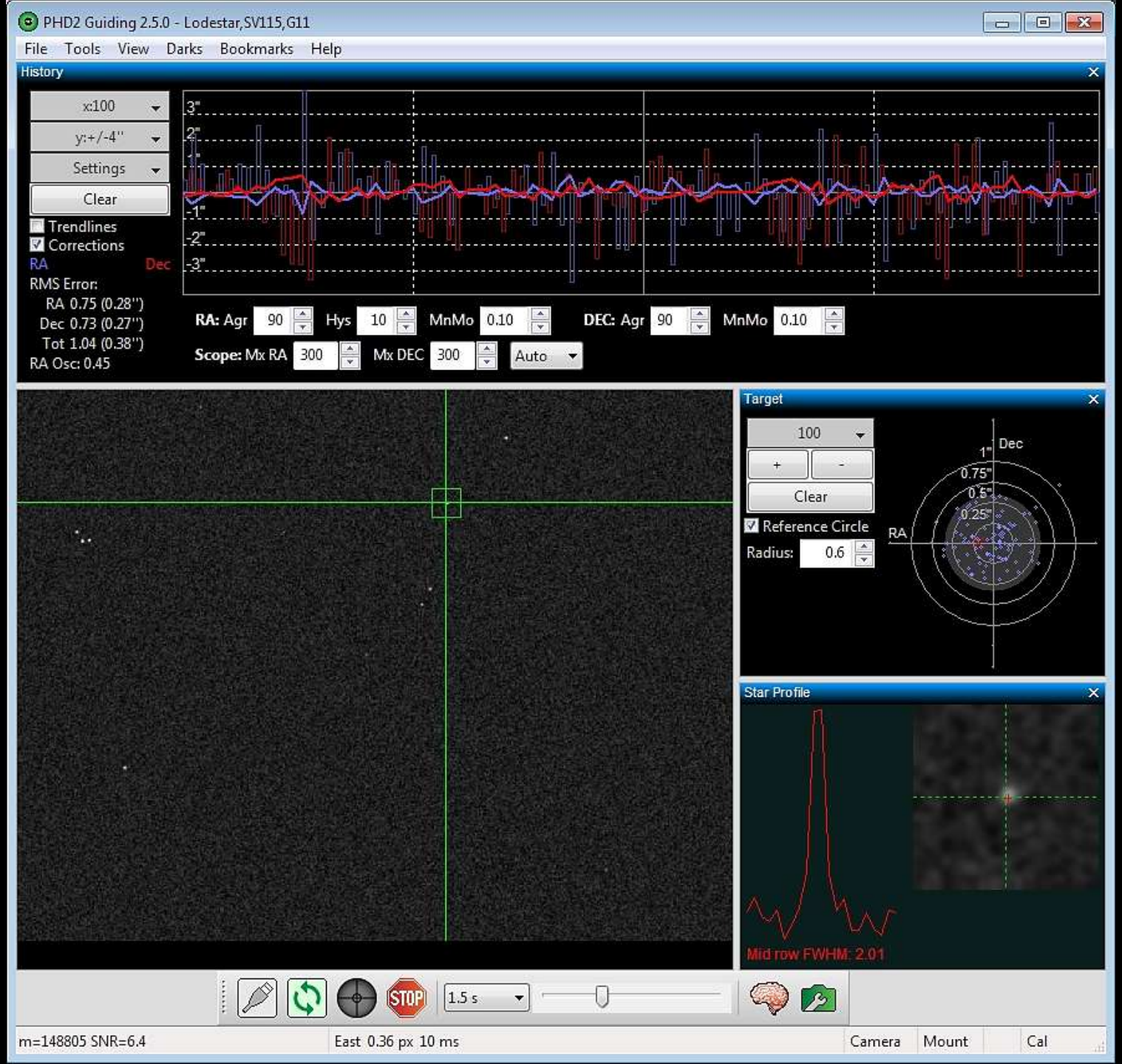
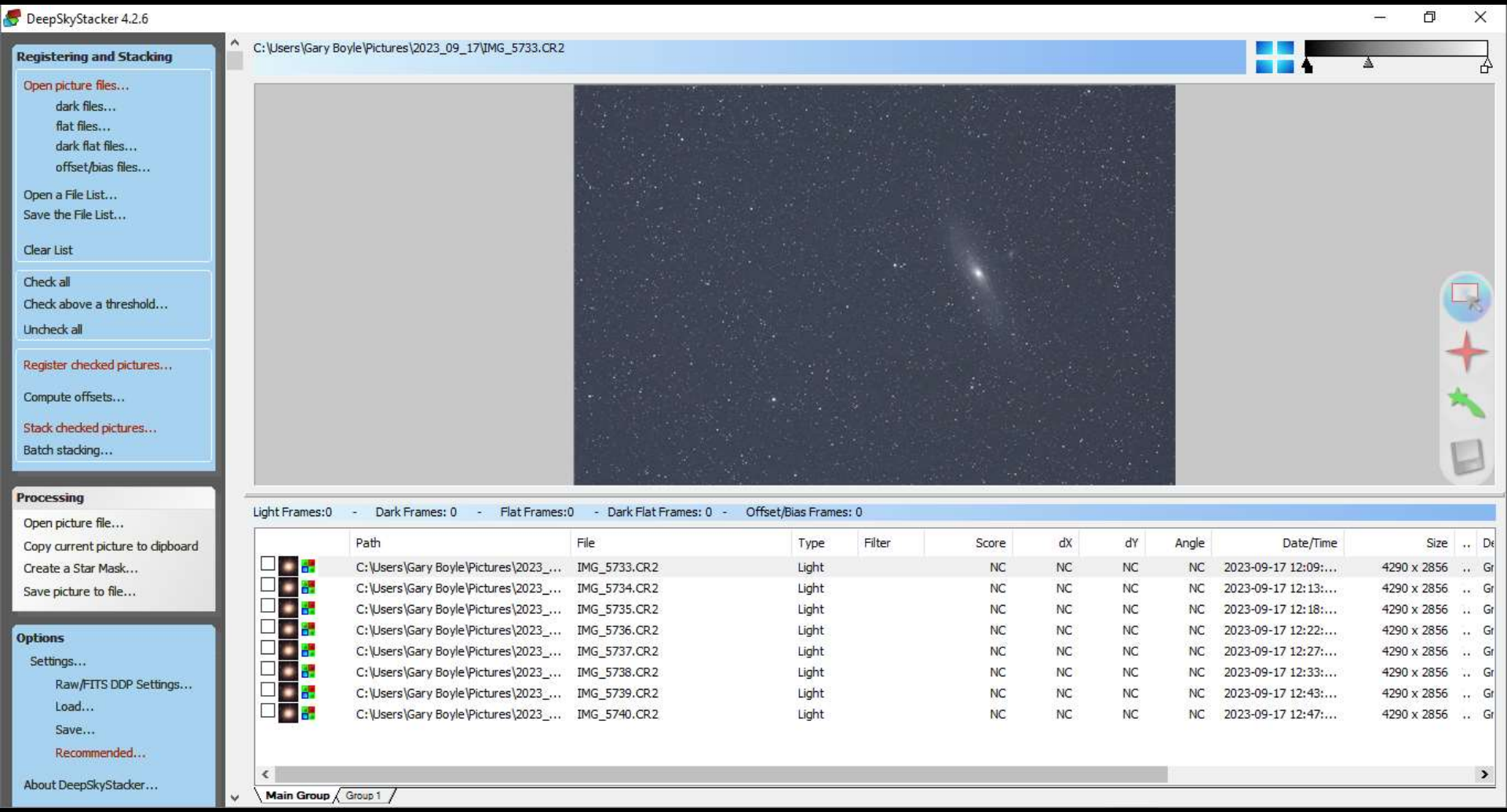
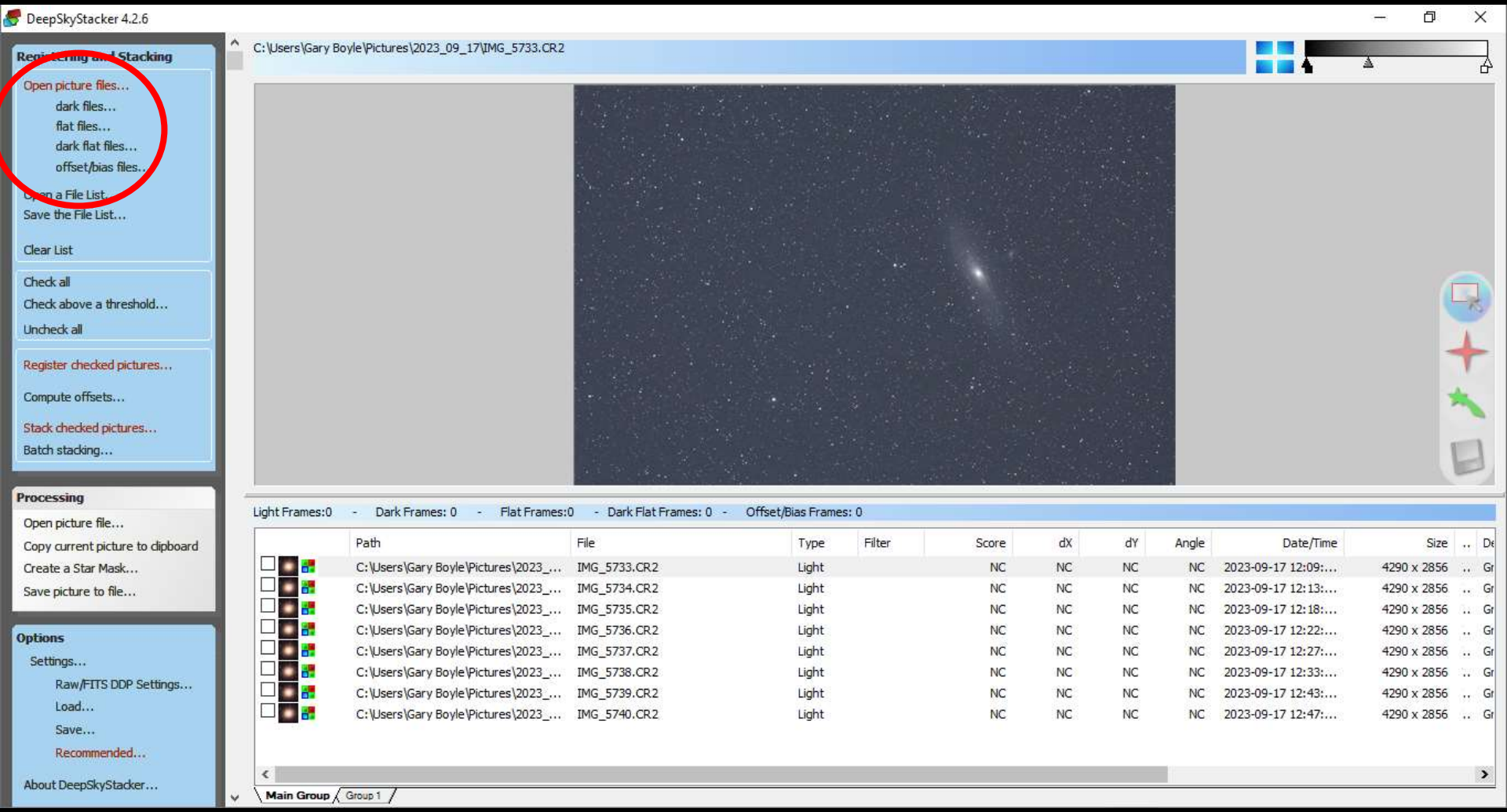

PHD2 Guiding 2.5.0 - Lodestar,SV115,G11
File Tools View Darks Bookmarks Help
History
x:100
y:+/-4''
Settings
Clear
Trendlines
Corrections
RA Dec
RMS Error:
RA 0.75 (0.28'')
Dec 0.73 (0.27'')
Tot 1.04 (0.38'')
RA Osc: 0.45
3"
2"
1"
-1"
-2"
-3"
RA: Agr 90 Hys 10 MnMo 0.10 DEC: Agr 90 MnMo 0.10
Scope: Mx RA 300 Mx DEC 300 Auto
Target
100
+
-
Clear
Reference Circle
Radius: 0.6
Dec
1"
0.75"
0.5"
0.25"
RA
Star Profile
Mid row FWHM: 2.01
STOP
1.5 s
m=148805 SNR=6.4
East 0.36 px 10 ms
Camera
Mount
Cal

Photo: Joe Bonner

Deep Sky Stacker (DSS)



Deep Sky Stacker (DSS)



At the End of the Night.
Flats / Dark Flats / Bias / Darks

Flats – Set camera to AV (aperture priority mode) and take about 20 subs with a light source in front of the camera lens or telescope before you change focus. Light source must be evenly illuminated from edge to edge.

Place lens cap on camera.

Dark Flats – set the camera to the same exposure from the flats and take about 20 subs.

Bias – set the camera to the highest shutter speed and take about 20 subs.

Darks – take about 10 subs of the same exposure you used for your lights. Example a 3-minute sub = a 3-minute dark. Long exposure noise reduction in some cameras will do this internally and subtract before saving RAW image. Must be done at the same temperature as the exposures.

Imaging Problems

Focus sharpness of stars
- No donuts – manual focus

Vignetting
- Over expose the interior of the frame (sub)

Tracking
- Will result in streaks rather than pinpoint

Sky Conditions
- Passing High Clouds

Planes / Satellites
- Crossing tracking through the field

Meteors
- A nice surprise

Dead Batteries
- Have spare (charged)

Dew
- Heater straps are a must

Registax 5

Photo: Gary Boyle

Photoshop Elements 10

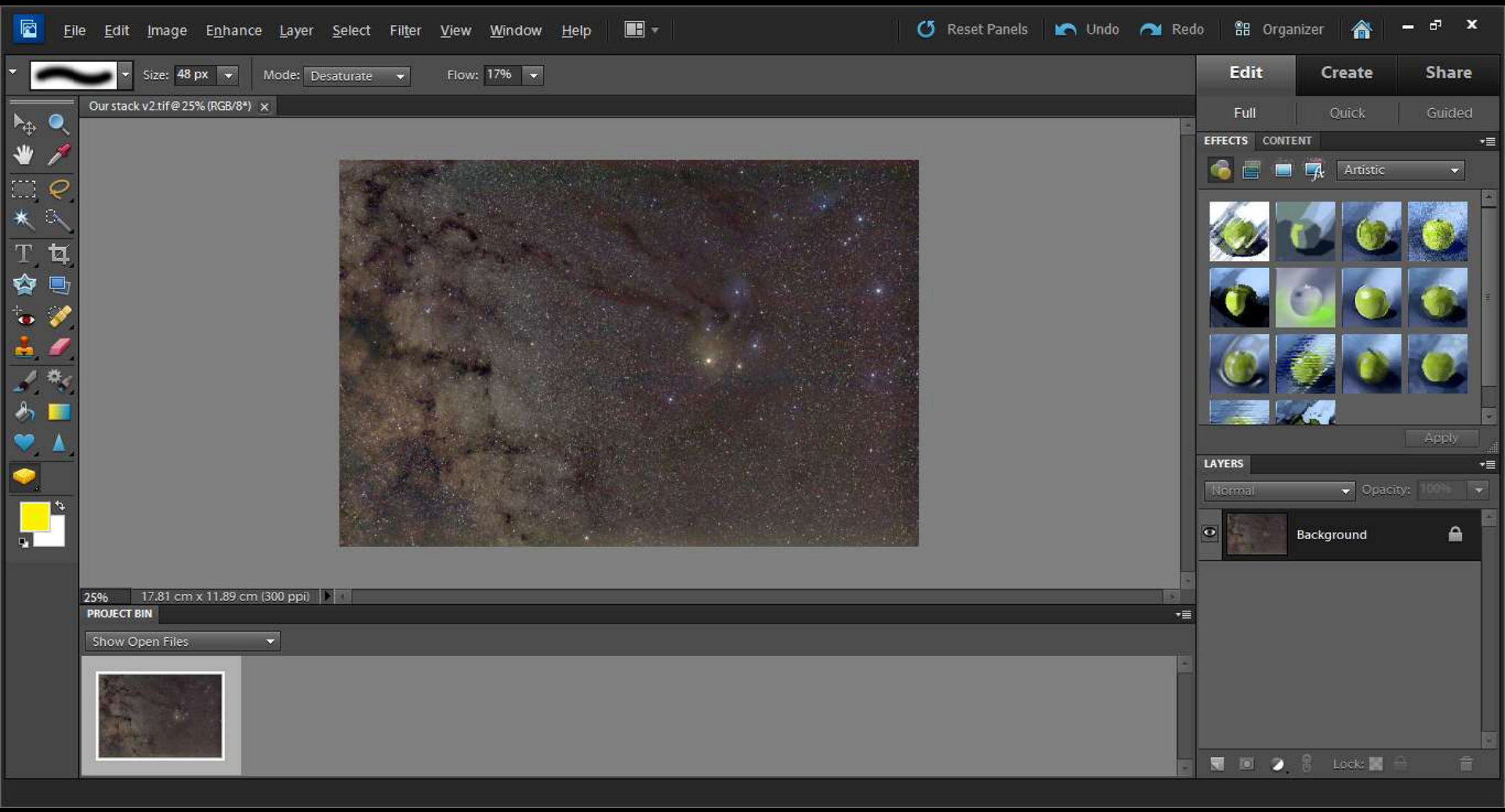


Photo: Gary Boyle

EQ6-R Pro
$2,730.00

Zenithstar 61
$806.00 +
Field Flattener
$362.00

ZWO ASI294MC Pro
$1,349.00 +
Field Flattener
$365.00

Guidescope
$112.00 +
Autoguider
$201.00

Filter Wheel
$539.00

LRGB Filters
$404.00

Narrowband Filters
$350.00 to
$550.00 each

Dew Strap
$97.00 each


CORONA

$9,675.00

$9,675.00

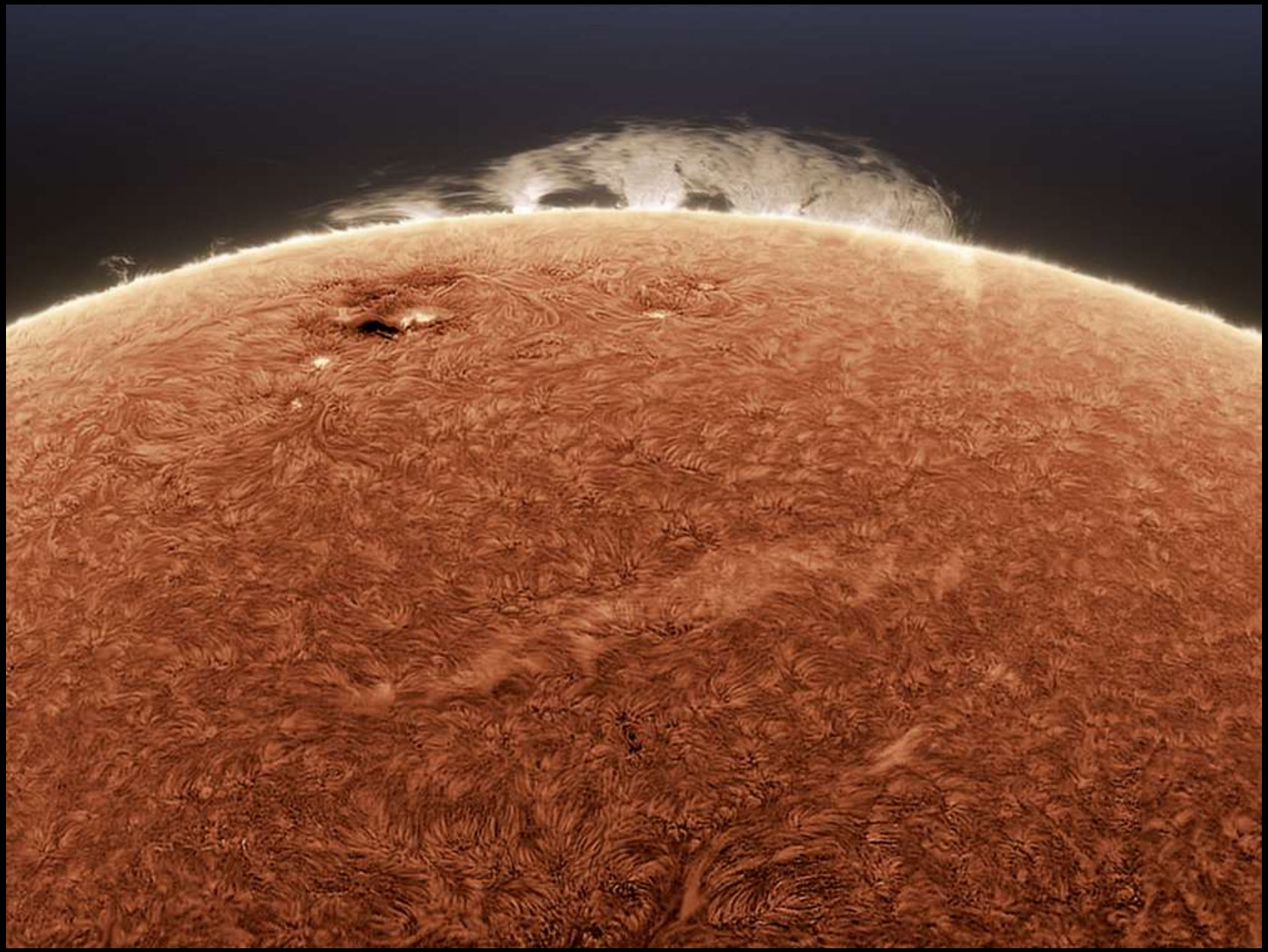


Photo: Alan Friedman

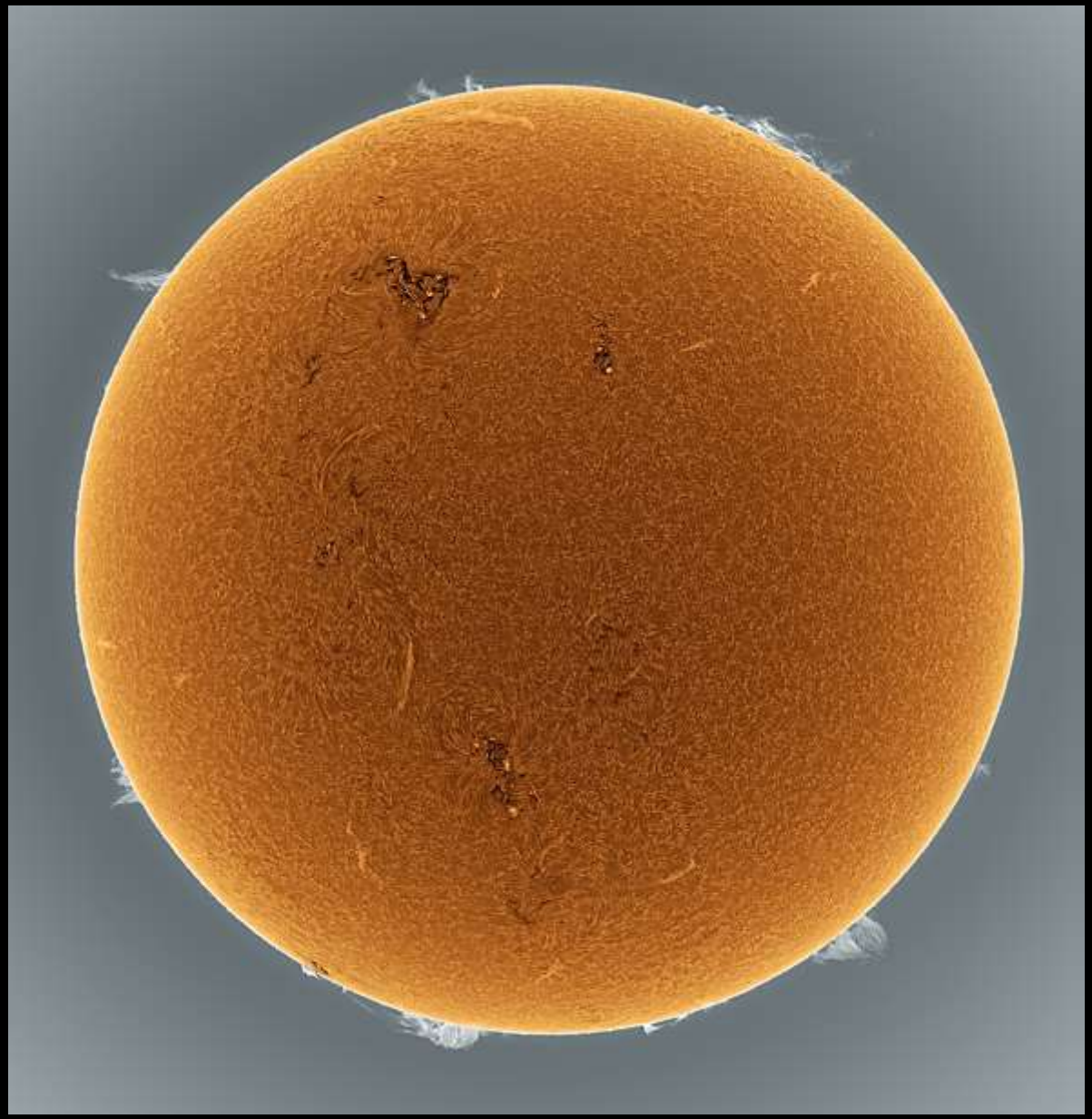


Photo: Alan Friedman

Coronado SolarMax III 90 Solar Scope

1/5

solar telescopes

Coronado SolarMax III 90 mm H-alpha Solar Telescope - 30 mm Blocking Filter - Double Stacked - 324014

Coronado —— SKU: COR-324014

☆☆☆☆☆ Write a review

1

$12,825.00 CAD

Add to cart

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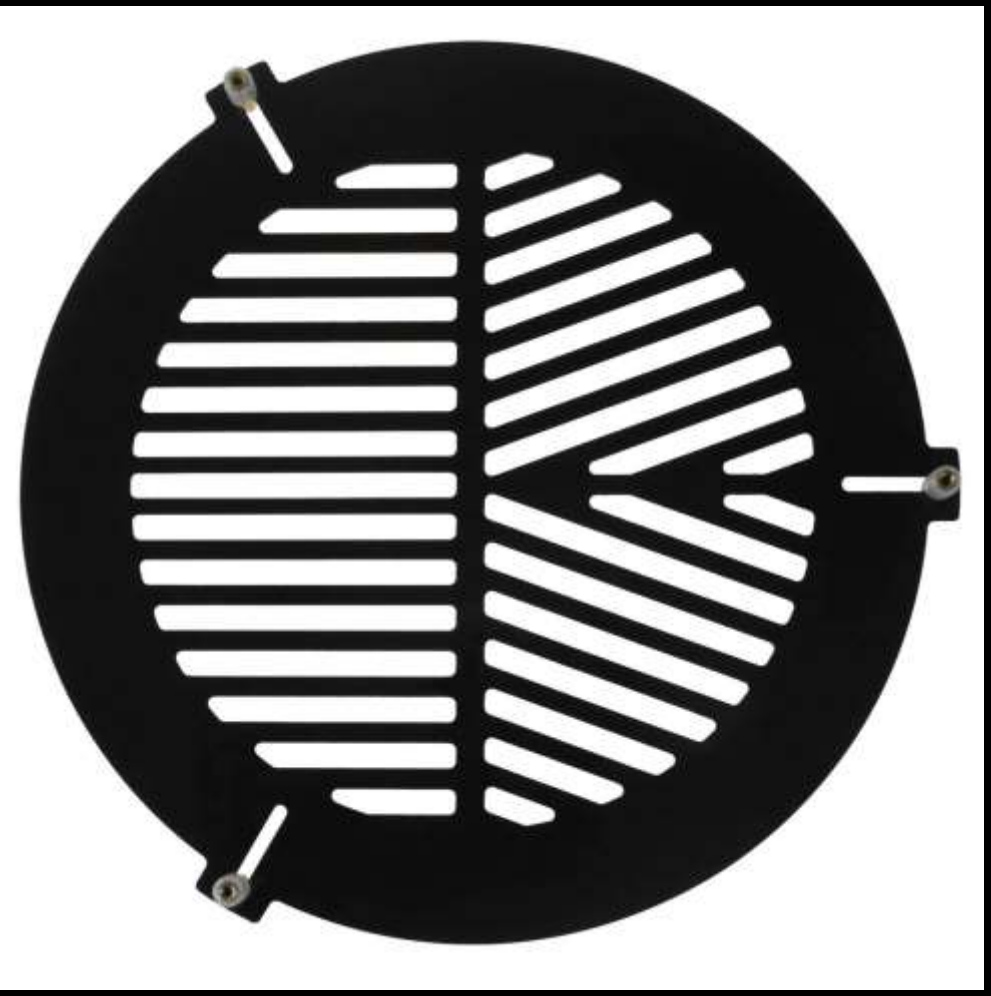
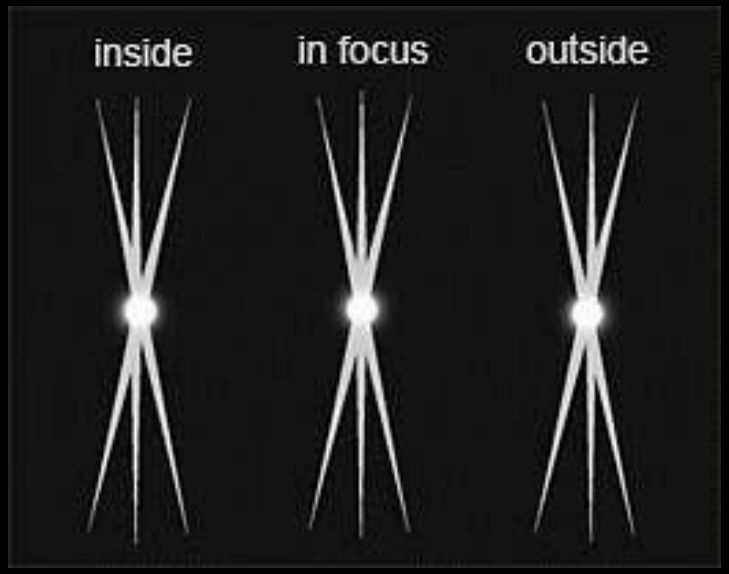
Hunting Supernovae

Batinov Mask






Canon

October 14, 2023
12:06 pm - 1:14 pm - 2:23 pm

20%

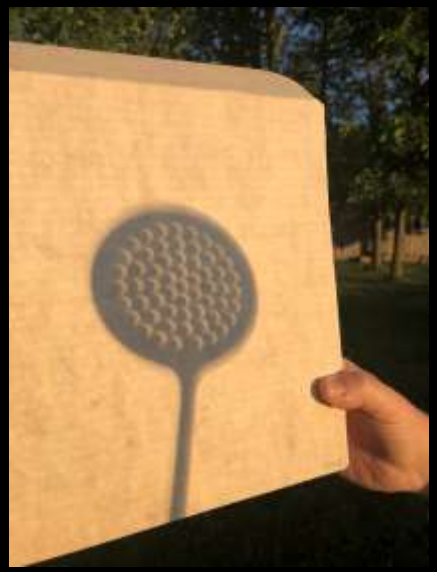


Photo: Gary Boyle

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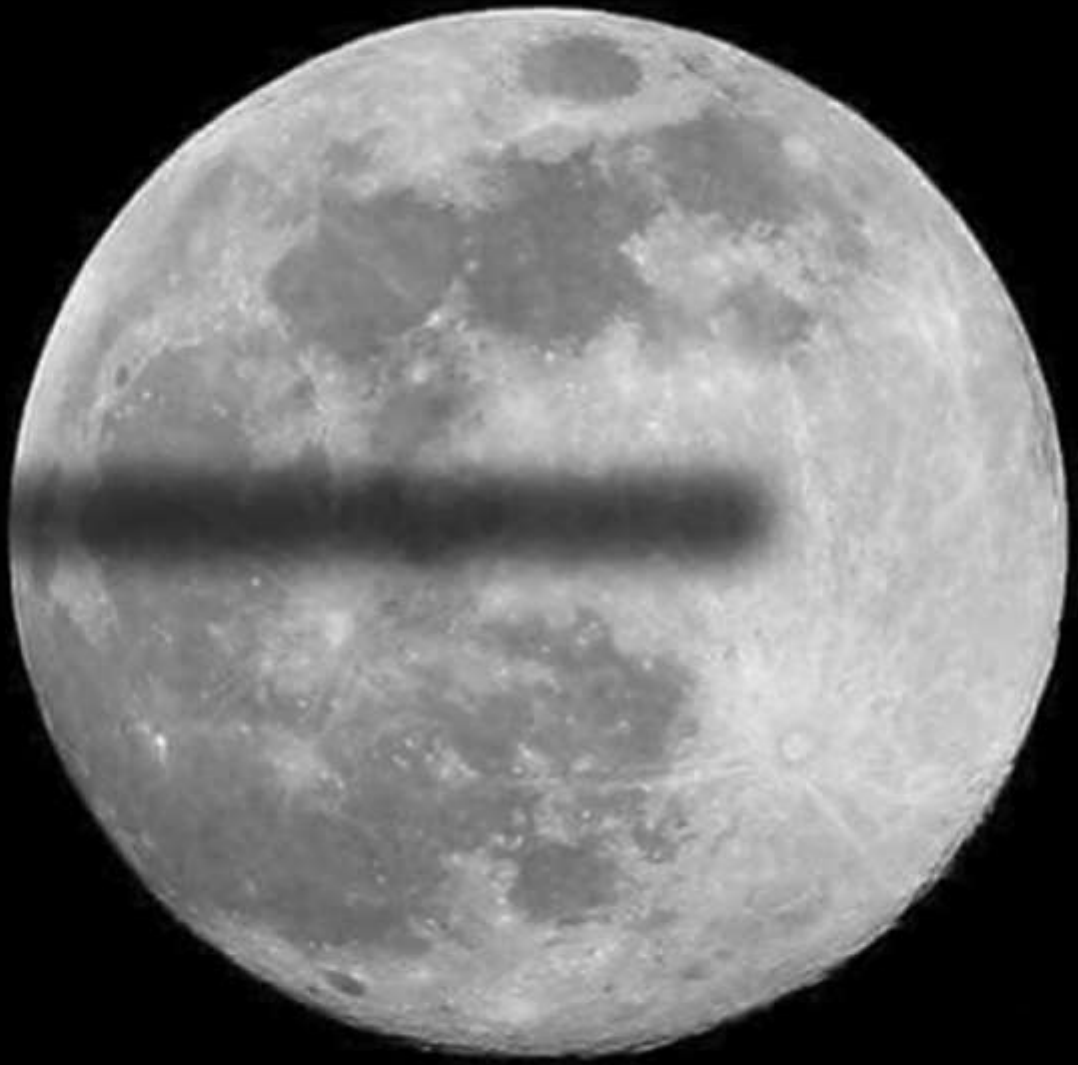

Photo: Gary Boyle

“Remember to look up at the stars and not down at your feet.

Try to make sense of what you see and wonder about what makes the universe exist.”

Stephen Hawking

THANK YOU

Photo: Gary Boyle

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gofundme.com/f/observatory-to-the-stars

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Observatory to the Stars

$150 raised of $18,000 goal

2 donations

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