

Object Information

General | Multimedia | Utility | Telescope

Object (1 of 2): Mars

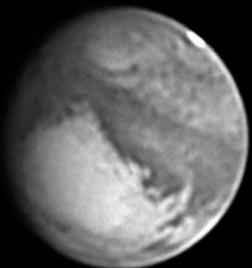
Item	Value
Object name	Mars
Magnitude	-2.2
Apparent magnit...	-2.2
Equatorial	RA: 02h 42m 25s Dec: +15°37'25"(current)
Equatorial 2000	RA: 02h 42m 04s Dec: +15°35'46"
Horizon	Azim: 159°29'49" Alt: +70°50'53"
Apparent angula...	00°00'19"
Visibility	Rise 17:06, Set 06:40
Transit time	23:50 Set: 6:40 AM on 11/12/2005 Rise: 5:05 PM on 11/12/2005 Transit: 11:50 PM
...	
Phase (%)	99.79
Object type	Mars



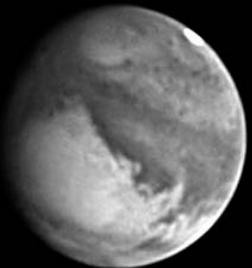
RGB

Mars 09/21/05 @ 07:45 UT
 CM: 325.72 Dia: 16.56" Ph: 91%, Stability 3-6/10 from Alpharetta, GA
 C14@F/36, Sony Monochrome ICX098BL based CCD camera, Filters:
 IR(700-980nm), RED(612-670nm), GREEN(488-574nm), BLUE(392-508nm)

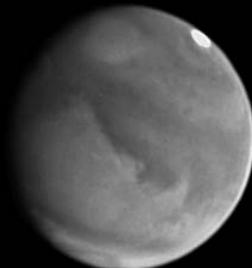
Larry Owens planetographer@comcast.net



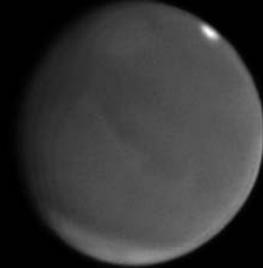
IR



RED



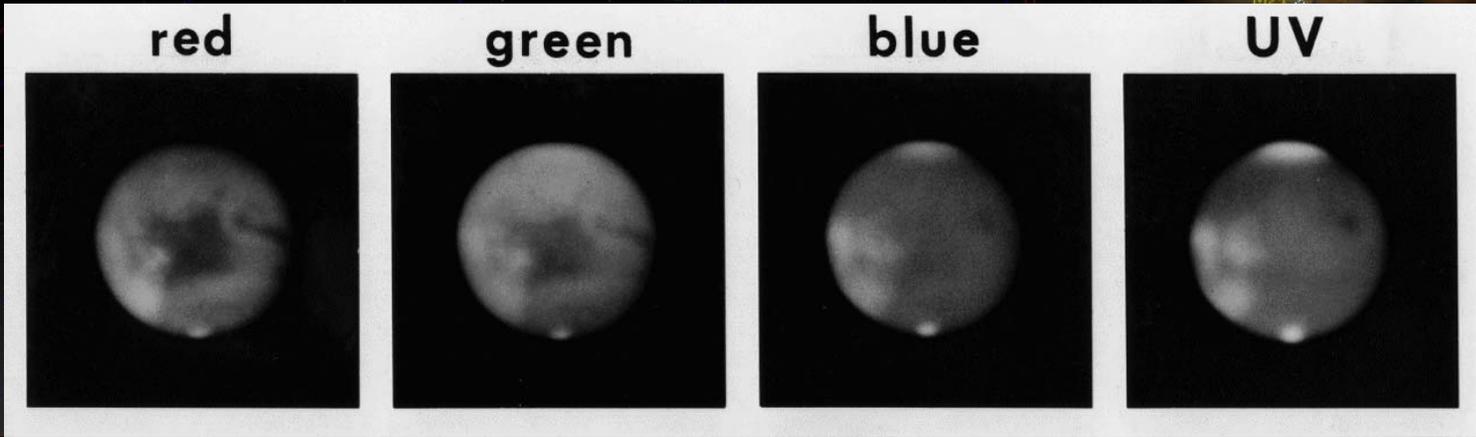
GREEN



BLUE

Planetary Imaging Workshop

Larry Owens



Lowell Observatory, 1971-1973



1971



1973



1973

CHANGES IN MARTIAN ALBEDO FEATURES
AND THE EFFECT OF A DUST STORM IN 1973
ARE SHOWN WITH COLOR RESTORED IMAGES.



DIFFERING COLORS OF MARTIAN STORM CLOUDS

OCT. 16, 1973 - 0900 UT

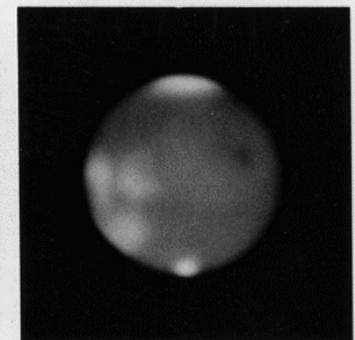
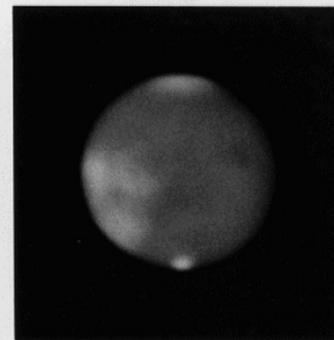
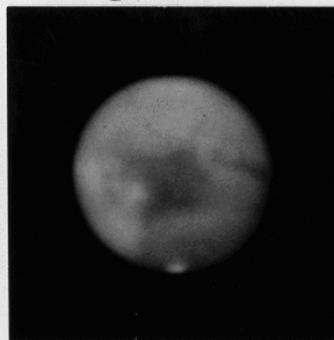
4th STORM DAY - 14.5 hrs. AST at 0°

red

green

blue

UV



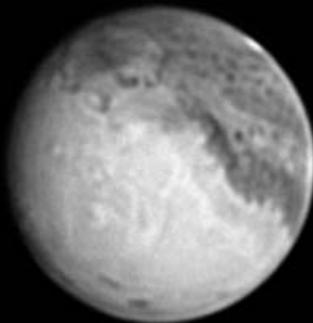
Backyard Telescope, 2005



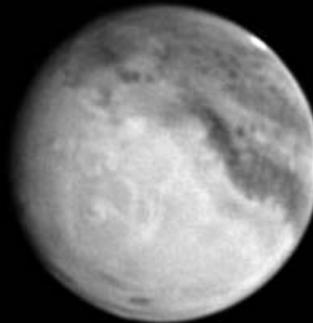
RGB

Mars 10/14/05 @ 08:57UT
CM: 133.97 Dia: 19.34" Ph: 97%, Stability 3-6/10 from Alpharetta, GA
C14@F/36, Sony Monochrome ICX098BL based CCD camera, Filters:
IR(700-980nm), RED(612-670nm), GREEN(488-574nm), BLUE(392-508nm)

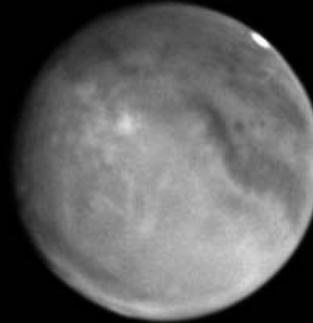
Larry Owens planetographer@comcast.net



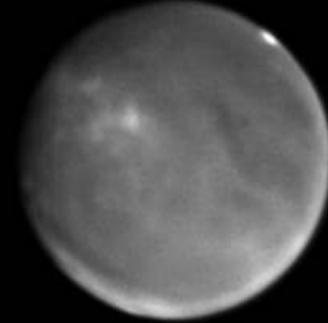
IR



RED



GREEN



BLUE

How is it Possible? How is it done?

Lowell Observatory Sequence, 1971



Valles Marineris Dust Storm



06:46UT CM: 57.42



06:53UT CM: 59.13



07:00UT CM: 60.83

Mars 10/19/05, Dia: 19.75", Phase 98%
Celestron NexImage Solar System Imager, C14 @ F/36
Larry Owens, planetographer@comcast.net

The Secret...

- Use the right tool for the job!



- Get the “sampling” right

- Use slower frame rates, longer exposures

The Secret...

- Use the right tool for the job!

- For the best images, 11" – 16" aperture
 - C9.5, high end refractors - exception
- Long inherent focal length
 - Schmidt-Cassegrain, Maksutov, Refractor (would be nice)
- Sturdy low PE equatorial mount
- Motorized focuser
- Monochrome CCD camera with filter wheel
 - Best images, best for analysis

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- Ideal – half the Dawes Limit per pixel
- Reduce, depending on atmospheric stability

- Use slower frame rates, longer exposures



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- 60-140ms, 5-15fps

• F-O-C-U-S!

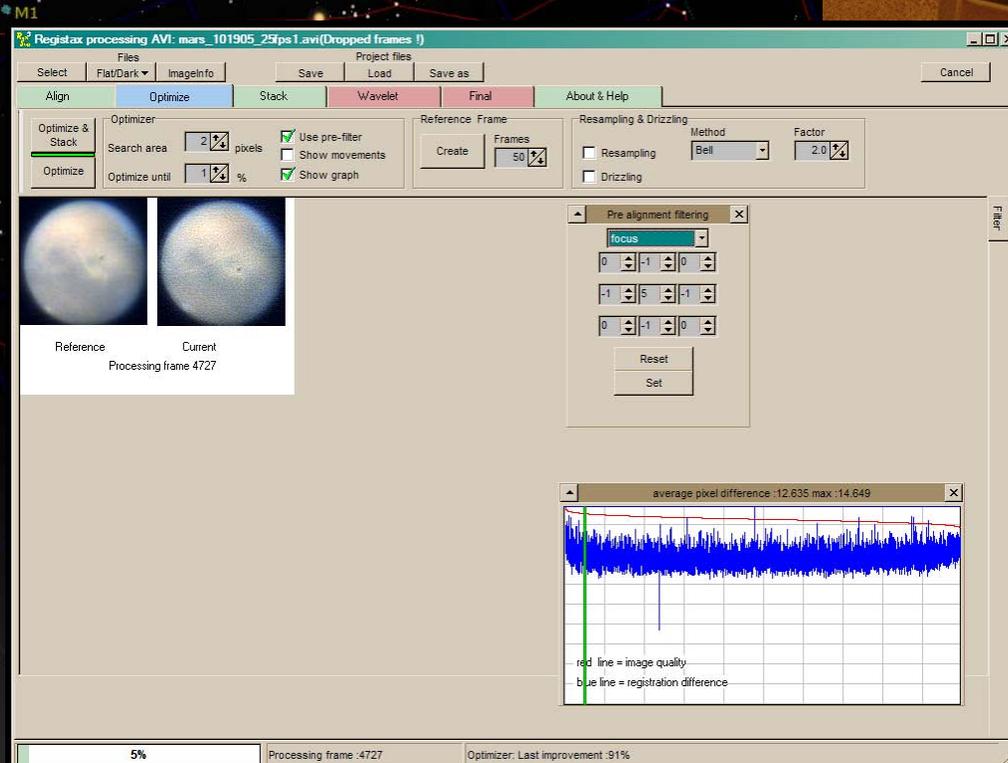
• C-O-L-L-I-M-A-T-I-O-N!

• E-X-P-E-R-I-M-E-N-T-A-T-I-O-N!



Acquisition

Using monochrome cameras & filters
Color cameras and resolution
Format: 640x480 or 320x240 (Sampling!)
Frame rates, compression & noise
How long to capture (fun with Algebra and Trig!)
Exposure, Gain and White Balance



Processing

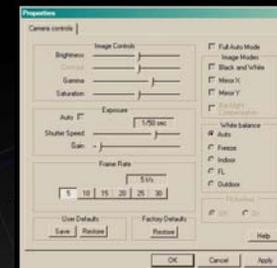
Reference frame selection
Alignment box size (feature or planet)
Quality settings, Pre-filter usage
To resample or not to resample
Selecting frames with stack graph
Selecting frames with frame list
Final adjustments and PhotoShop
Data to present with your image

Acquisition



Acquisition Strategies

- Acquisition Software
 - VRecord, AMcap
 - AstroVideo, IC Capture, K3CCD Tools
 - StreamPix, MaximDL
- Things to consider
 - Raw image feature resolution
 - Frame resolution
 - Monochrome cameras and filters
 - Experiment with Exposure and Gain



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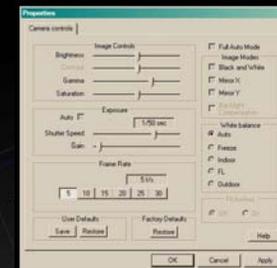
- Raw image feature resolution

- If good, acquire frames for longer period – for Feature based alignment
- If very soft, acquire frames according to rotation maximum

- Frame resolution

- Monochrome cameras and filters

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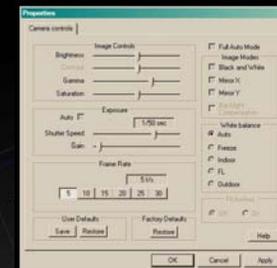
- If good, acquire frames for longer period – for Feature based alignment
- If very soft, acquire frames according to rotation maximum

- Frame resolution

- 640x480, sub-frame, 320x240
- Planet angular diameter, sampling, chip area

- Monochrome cameras and filters

- Experiment with Exposure and Gain



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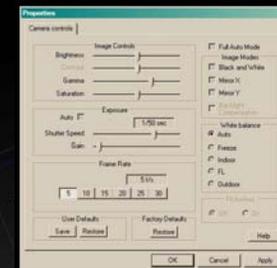
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- Consider time it takes to acquire full RGB sets (color shift tolerance)
- Plan for LRGB (if desired): color set – luminance set – color set
- Consider filter to use for Luminance – UV/IR block, IR, Red, Green
- Watch filter distance from chip in optical train

- Experiment with Exposure and Gain



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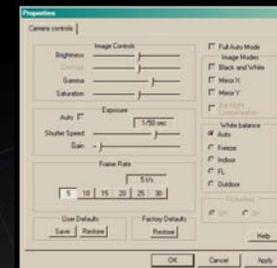
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- Experiment with Exposure and Gain

- Longer exposures, lower gain, fewer frames
- Shorter exposures, higher gain, higher frame counts



Monochrome Cameras

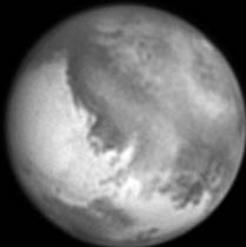
- Lumenera
- Atik
- Modified Philips Cams (mono chip + raw mode)
- CCD Cameras
- Filter wheel or slider
- Filters
- Full Chip Resolution
- Color Combine in MaximDL



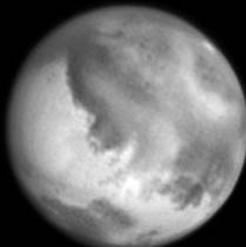
RGB

Mars 10/27/05 @ 07:39UT
 CM: 359.52 Dia: 20.12" Ph: 99%, Stability 4-5/10 from Alpharetta, GA
 C14@F/36, Sony Monochrome ICX098BL based CCD camera, Filters:
 IR(700-980nm), RED(612-670nm), GREEN(488-574nm), BLUE(392-508nm)

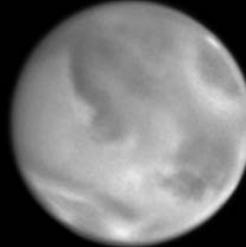
Larry Owens planetographer@comcast.net



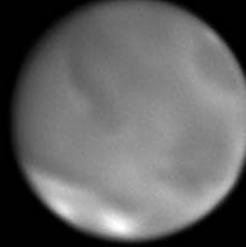
IR



RED



GREEN



BLUE

Schuler Standard Bandpass

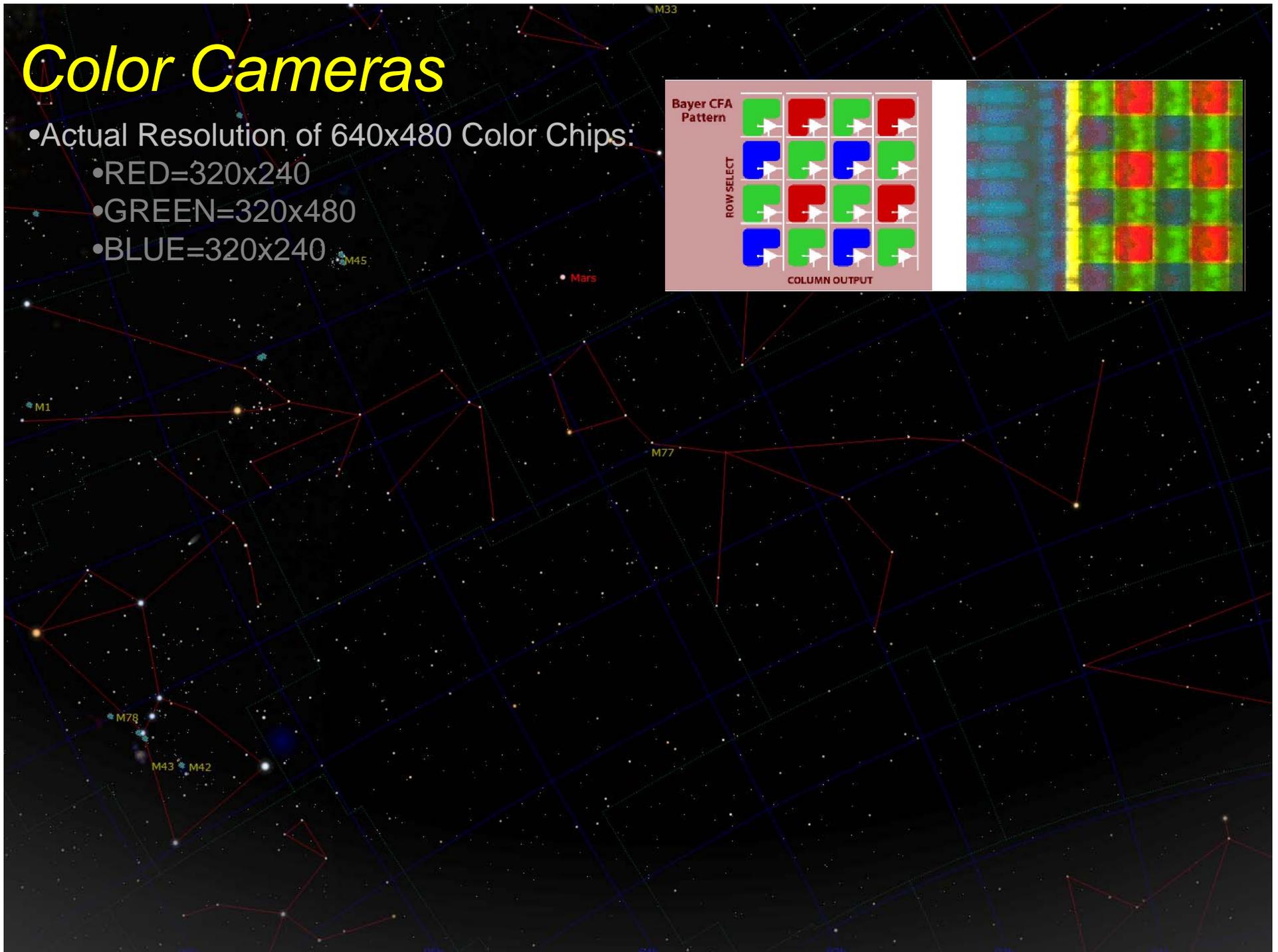
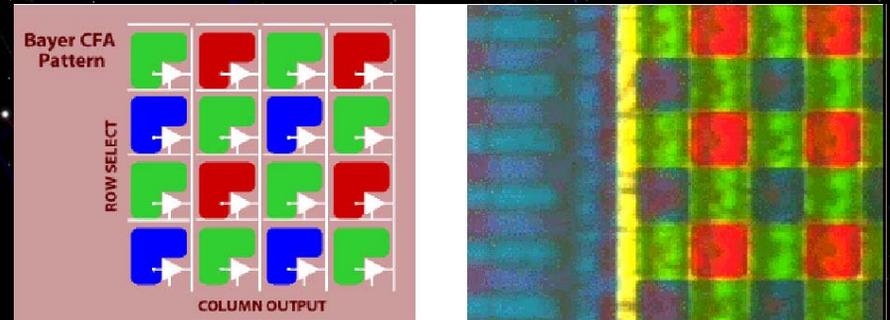
UV	345-385nm	70%
Bu	375-475nm	75%
V	488-688nm	86%
Rs	570-725nm	78%
Is	700-980nm	77%

Custom Scientific (RGB)

R	612-670nm	97%
G	488-574nm	96%
B	392-508nm	95%

Color Cameras

- Actual Resolution of 640x480 Color Chips:
 - RED=320x240
 - GREEN=320x480
 - BLUE=320x240



Color Cameras

- Actual Resolution of 640x480 Color Chips:

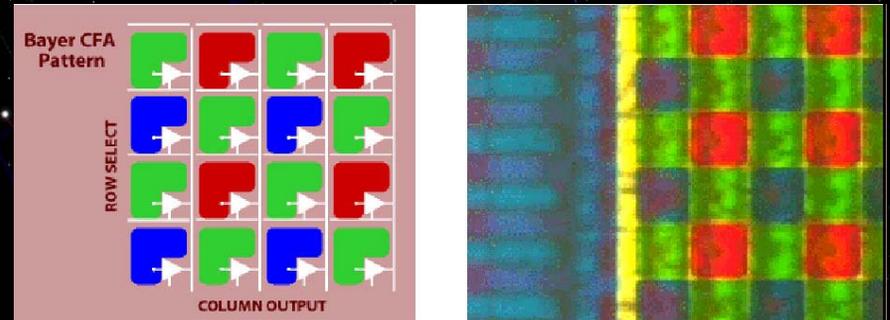
- RED=320x240

- GREEN=320x480

- BLUE=320x240

- At 320x240, Full color resolution (use RAW mod to be sure, see link)

<http://www.astrosurf.com/astrobond/ebrawe.htm>



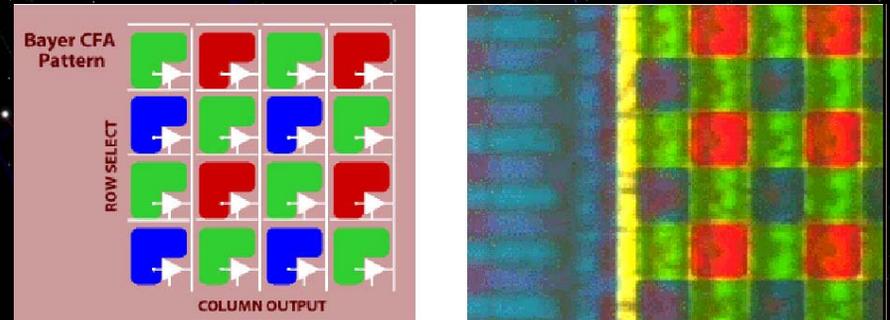
Color Cameras

- Actual Resolution of 640x480 Color Chips:

- RED=320x240

- GREEN=320x480

- BLUE=320x240



- At 320x240, Full color resolution (use RAW mod to be sure, see link)

- <http://www.astrourf.com/astrobond/ebrawe.htm>

- At 640x480, Something less than full resolution

- Bayer pattern interpolation

- Twice the resource usage without twice the resolution

- Longer stacking and processing times

- High resource usage can cause processing problems

- 640x480 usage

- If you can't get the sampling right (more on this later)

- Short focal length Newtonians

- Philippe Bernascolle has performed some interesting resolution tests with ToUcams

- <http://www.astrourf.com/astrobond/Using-RAW-Mode.pdf>

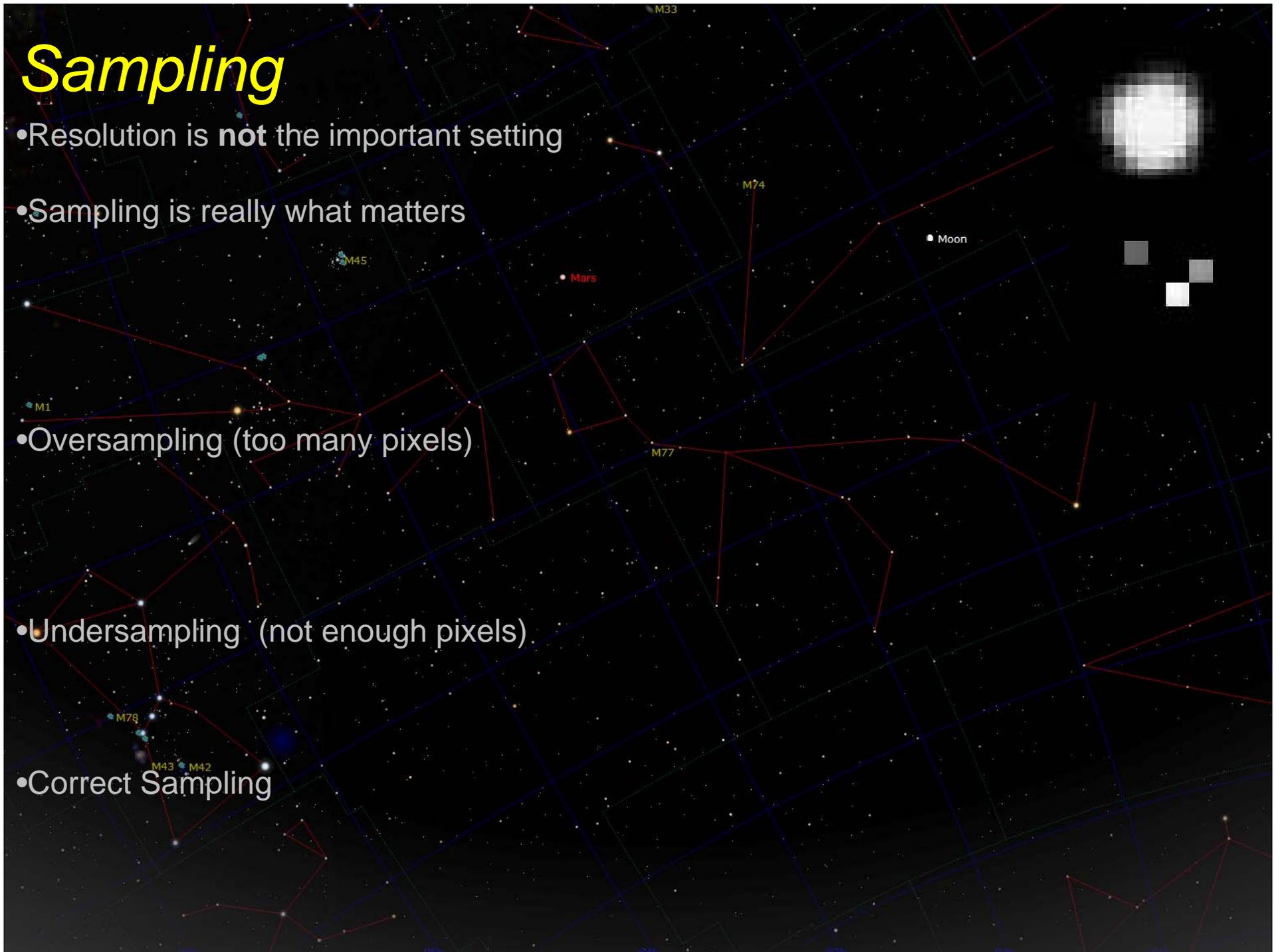
Sampling

- Resolution is **not** the important setting
- Sampling is really what matters

- Oversampling (too many pixels)

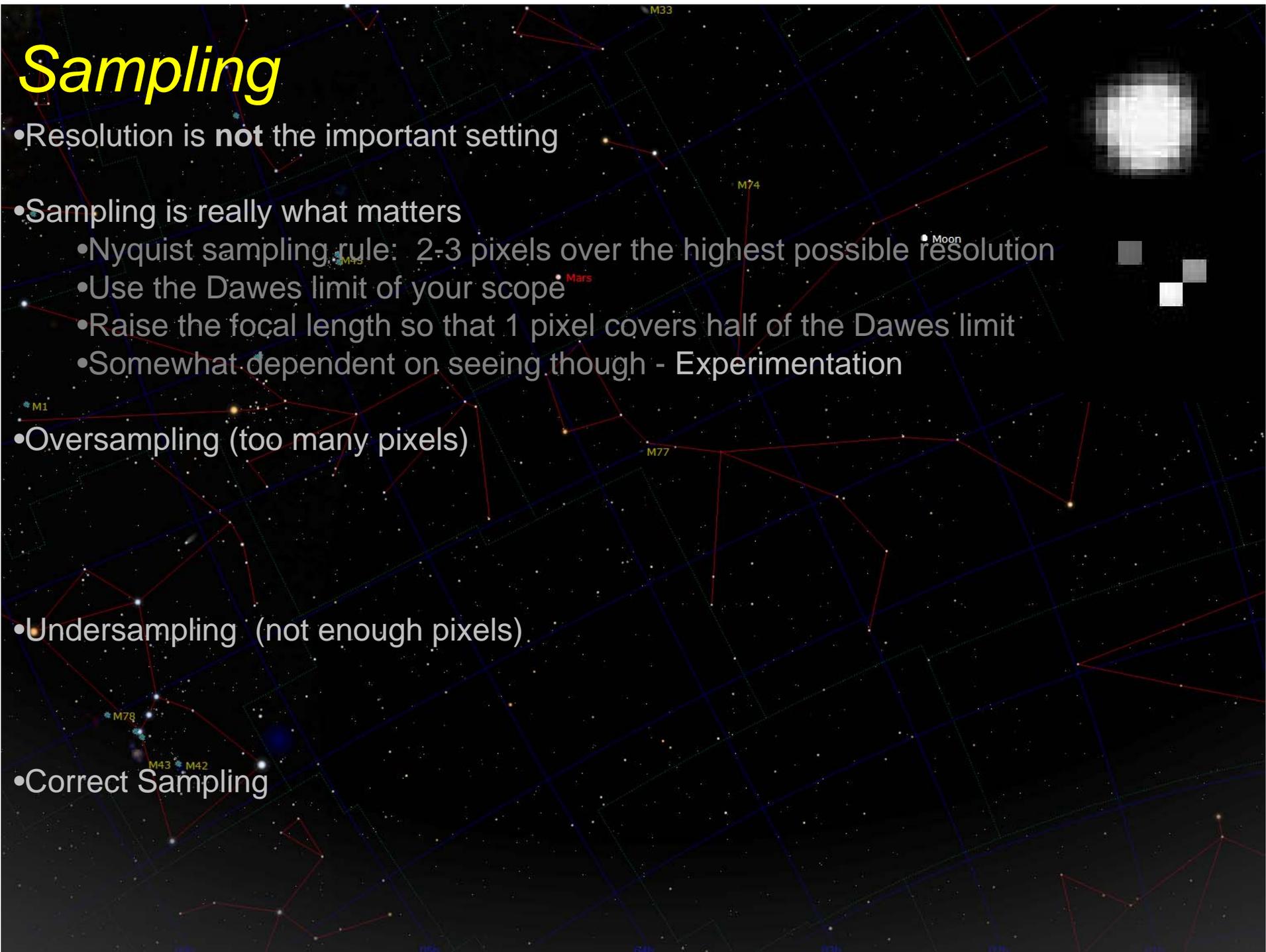
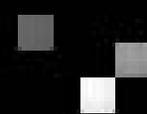
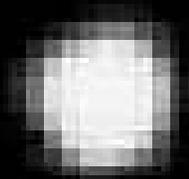
- Undersampling (not enough pixels)

- Correct Sampling



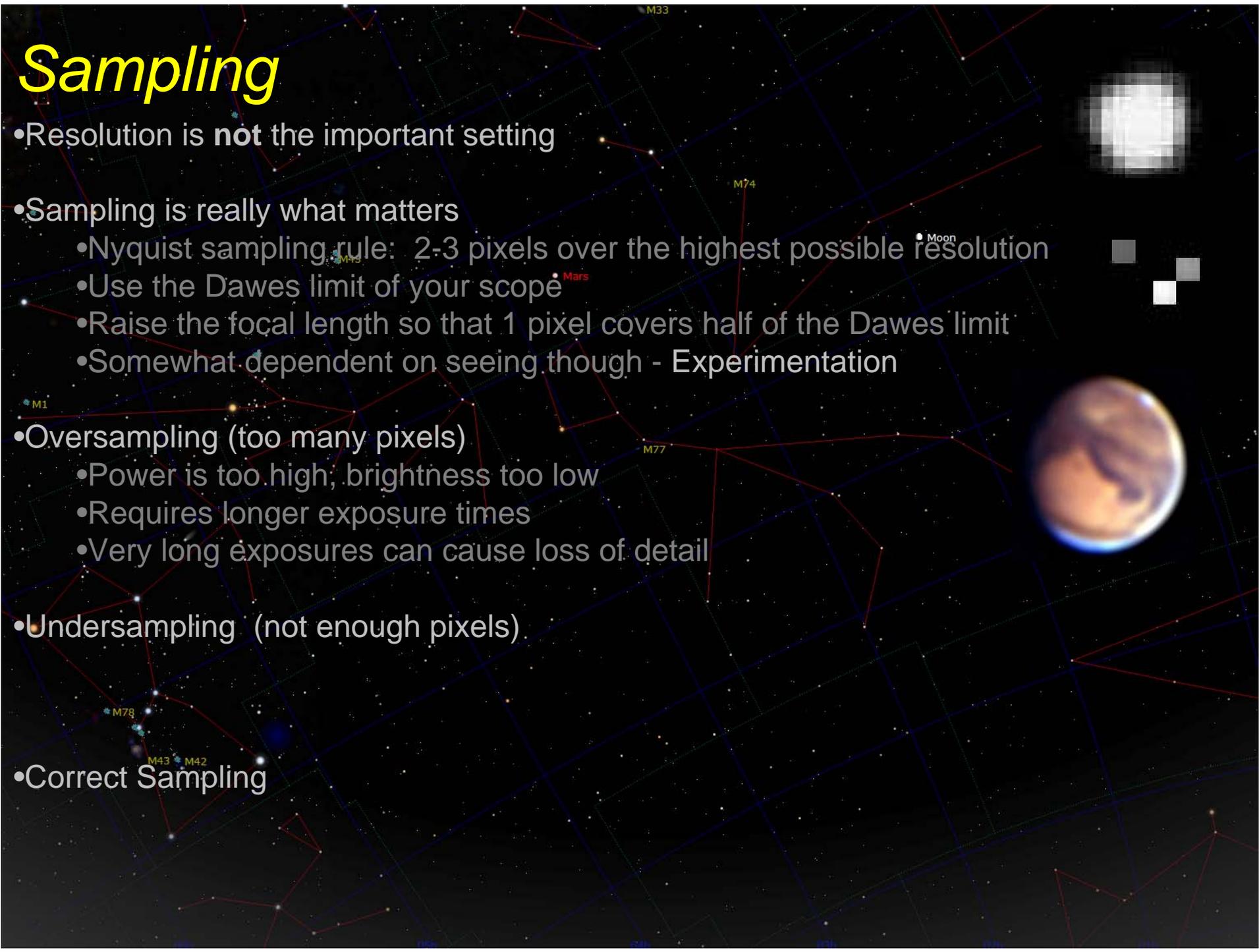
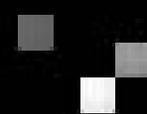
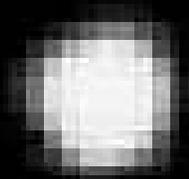
Sampling

- Resolution is **not** the important setting
- Sampling is really what matters
 - Nyquist sampling rule: 2-3 pixels over the highest possible resolution
 - Use the Dawes limit of your scope
 - Raise the focal length so that 1 pixel covers half of the Dawes limit
 - Somewhat dependent on seeing though - Experimentation
- Oversampling (too many pixels)
- Undersampling (not enough pixels)
- Correct Sampling



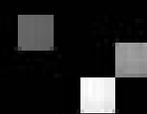
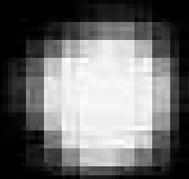
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 - Power is too high; brightness too low
 - Requires longer exposure times
 - Very long exposures can cause loss of detail
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- Correct Sampling



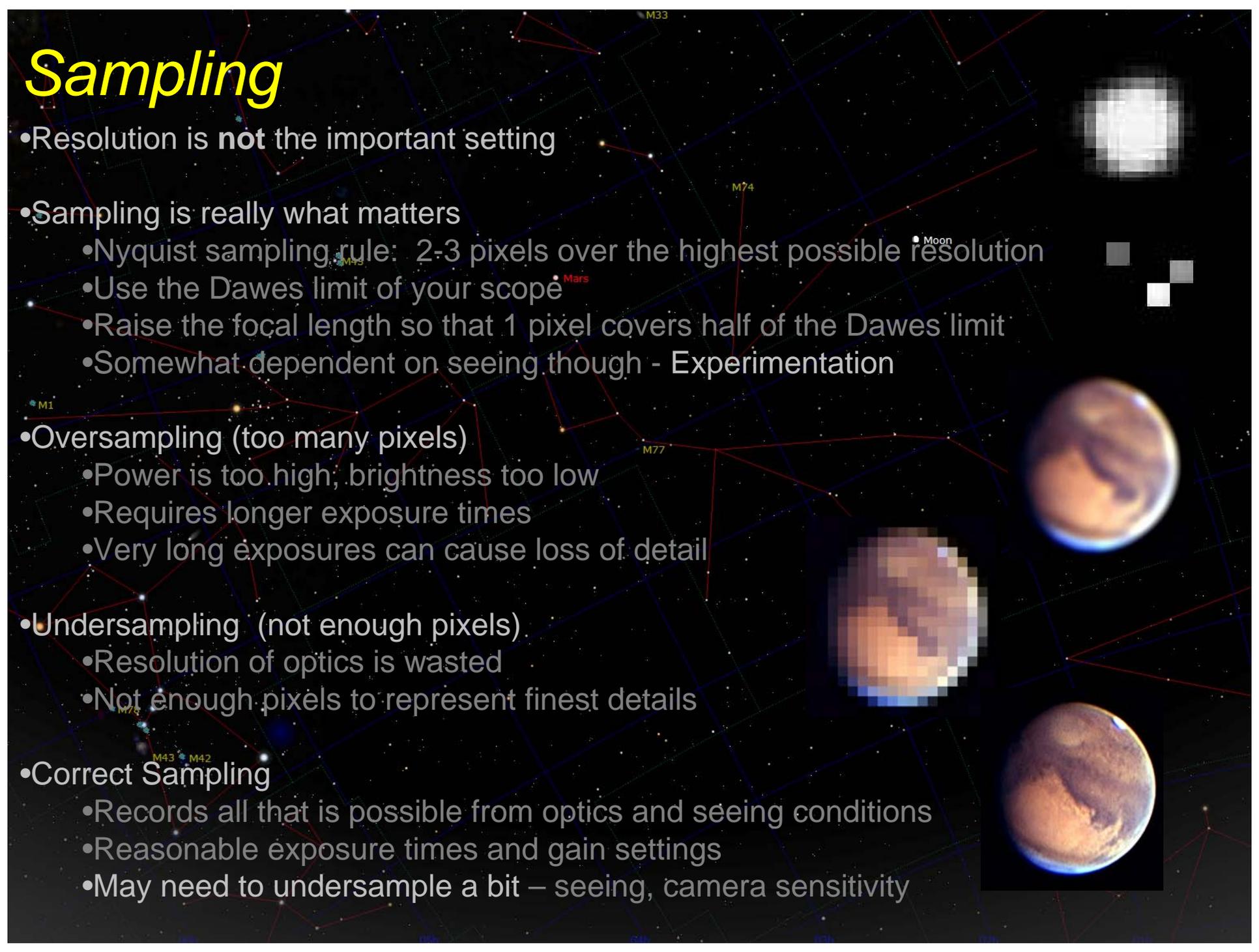
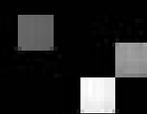
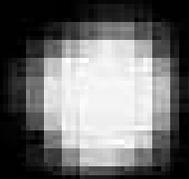
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 - Not enough pixels to represent finest details
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 - Resolution of optics is wasted
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- Correct Sampling
 - Records all that is possible from optics and seeing conditions
 - Reasonable exposure times and gain settings
 - May need to undersample a bit – seeing, camera sensitivity



Sampling

- Dawes Limits: (116/aperture in mm)

4" - 1.14"

8" - .57"

10" - .46"

11" - .41"

14" - .33"

16" - .29"

- Pixel Sizes:

ICX098BL – 5.6μ (Toucam, ATIK 1/4")

KAF402 – 9μ (ST-402ME, ST-7E)

TC-237 – 7.4μ (ST-237)

ICX424 – 7.4μ (Lumenera & other 1/3" Cams)



- Two ways to find arc seconds per pixel:

- Arcseconds per pixel = $\frac{(\text{Pixel Size in microns})206}{\text{Focal length in mm}}$ *(Must know exact FL)*

- Arcseconds per pixel = $\frac{\text{Size in arcseconds of known object}}{\text{Number of pixels across known object}}$ *(Must know angular size of Planet)*



- Now you can find your exact focal length:

- Focal length = $\frac{(\text{Pixel Size in microns})206}{\text{Arcseconds per pixel}}$



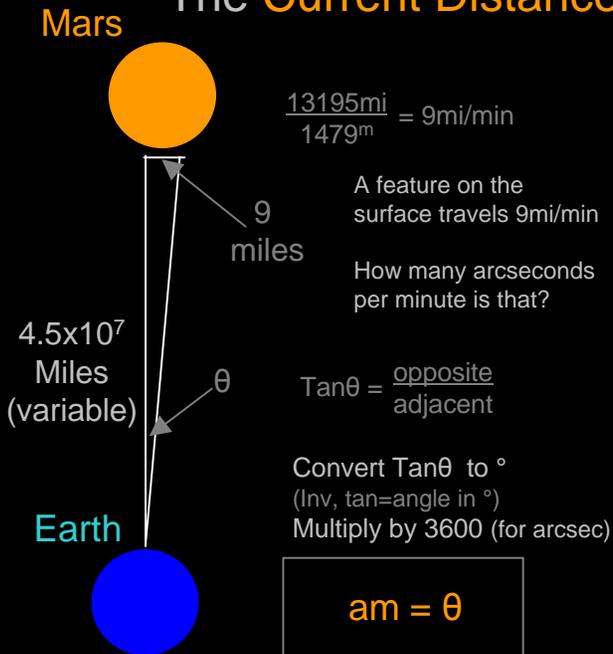
How Long to Capture Frames

- Planetary rotation can affect the image in as little as 5 minutes
- ***Theoretically***, capture time should not exceed the time it takes the planet to rotate through one pixel
 - In reality, longer times are fine – seeing, arcsec/pixel vary – Experimentation!
 - Times can be extended if you align by feature (more later)
 - *Two ways to calculate:*

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When you know
The **Current Distance**



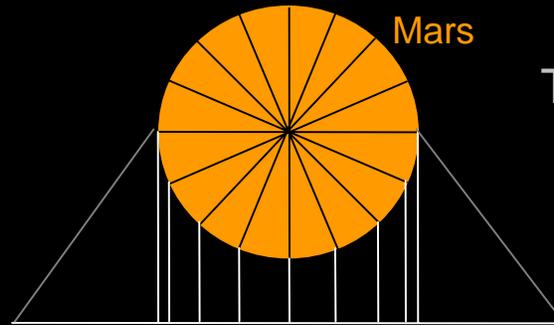
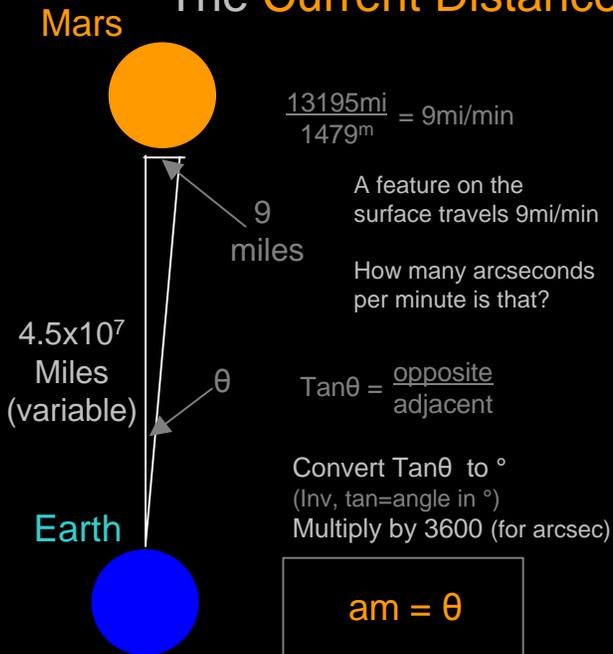
Diameter=4,200mi
Circumference=13,195mi (πD)
Period of Rotation=24^h 39^m (1479^m)
Apparent Diameter=19.45"
Distance from Earth=44,701,711mi

$$\text{Cap Limit} = \frac{\text{arcsec per pixel}}{am}$$

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When you know The Current Distance



When you know The Apparent Diameter

Diameter=4,200mi
Circumference=13,195mi (πD)
Period of Rotation=24^h 39^m (1479^m)
Apparent Diameter=19.45"
Distance from Earth=44,701,711mi

- 1) Find the "apparent" half circumference
- 2) Now find "apparent" motion

$$\frac{hc}{hc'} = \frac{d}{d'}$$

$$\frac{hc'}{hd} = \frac{am}{T}$$

$$d(hc') = hc(d')$$

$$hd(am) = hc'(T)$$

$$hc' = \frac{hc(d')}{d}$$

$$am = \frac{hc'(T)}{hd}$$

d = diameter (4200mi)
 d' = apparent diameter (arcsec)(var)
 hc = half circumference (6598mi)
 hc' = apparent length of hc (arcsec)
 hd = half day (740min for Mars)
 am = apparent motion (arcsec/min)
 T = Time (minutes)

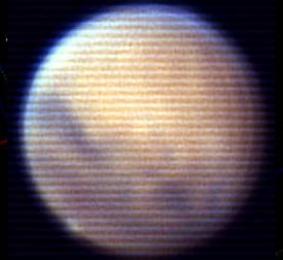
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Frame Rates

• Compression issue (Not a problem with CCD Cameras, SBIG, Lumenera)

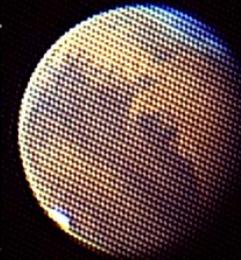
• Noise issue

NexImage

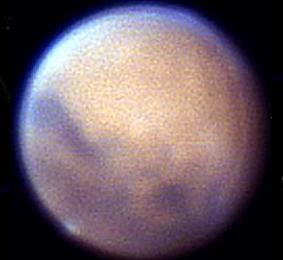


30fps

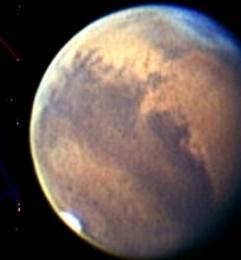
ToUcam Pro



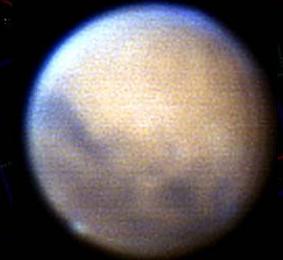
20fps



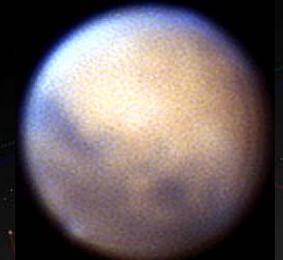
25fps



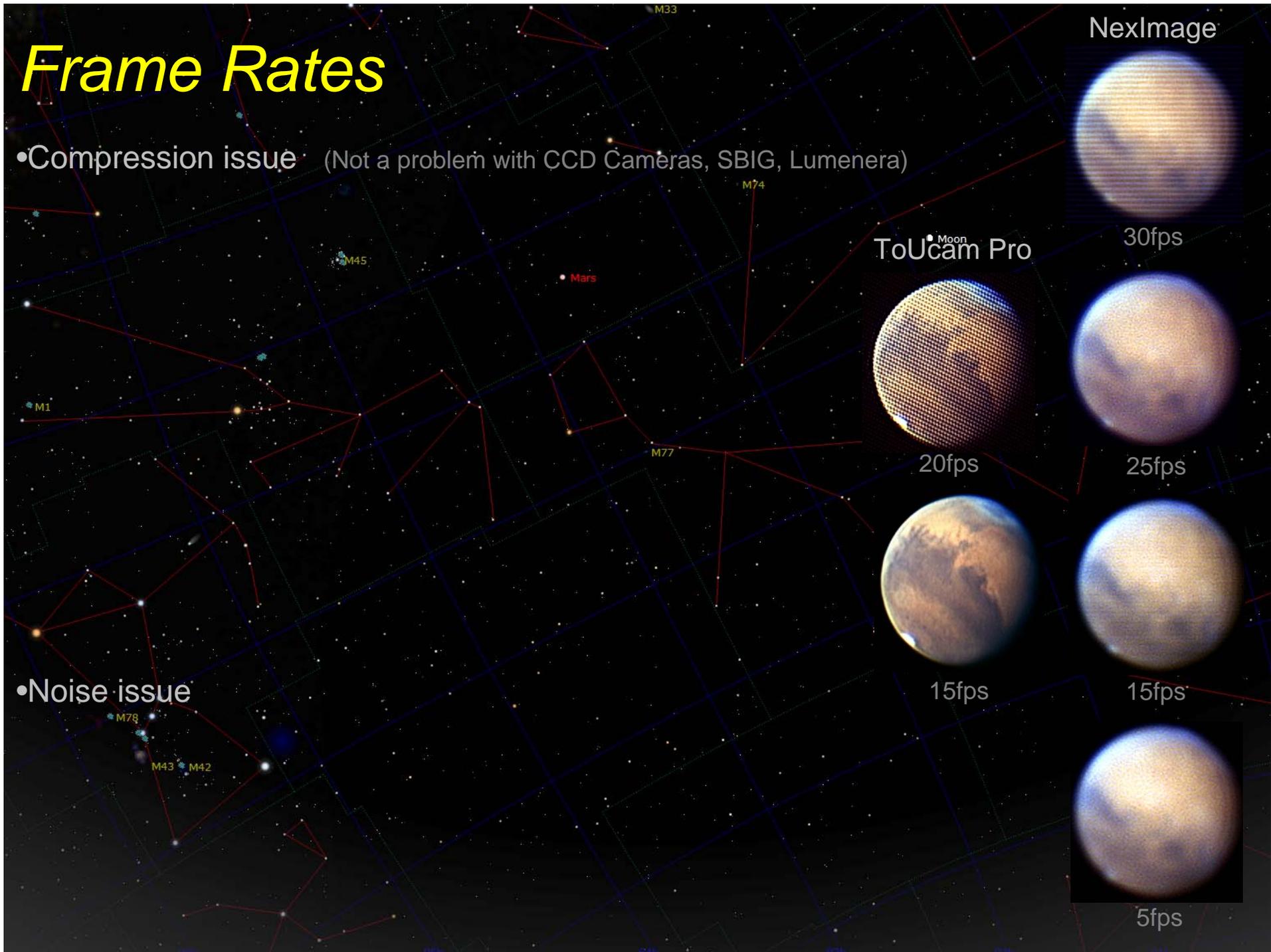
15fps



15fps



5fps



Frame Rates

- Compression issue (Not a problem with CCD Cameras, SBIG, Lumenera)

- Above a certain frame rate the camera performs compression

- Effects of compression *not visible on video*

- Causes **severe** processing artifacts

- ToUcam Pro

- Starts compression at 20fps and above

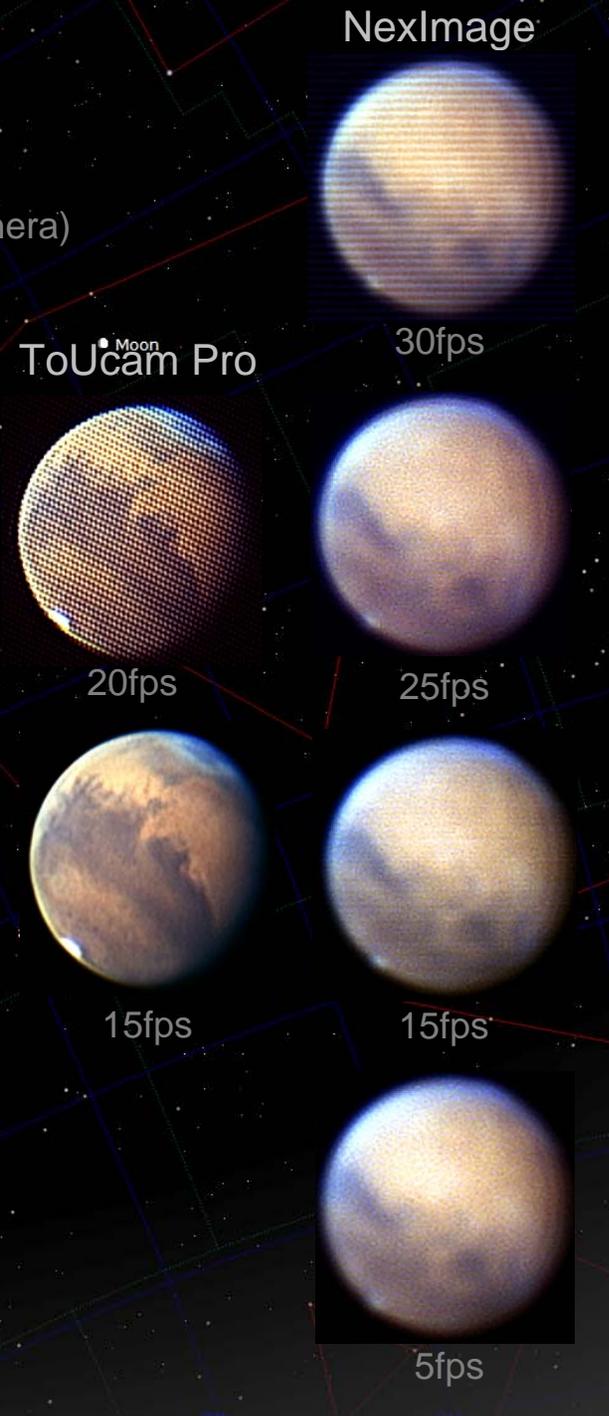
- 5, 10 and 15 fps are fine

- Celestron NexImage

- Starts compression at 30fps

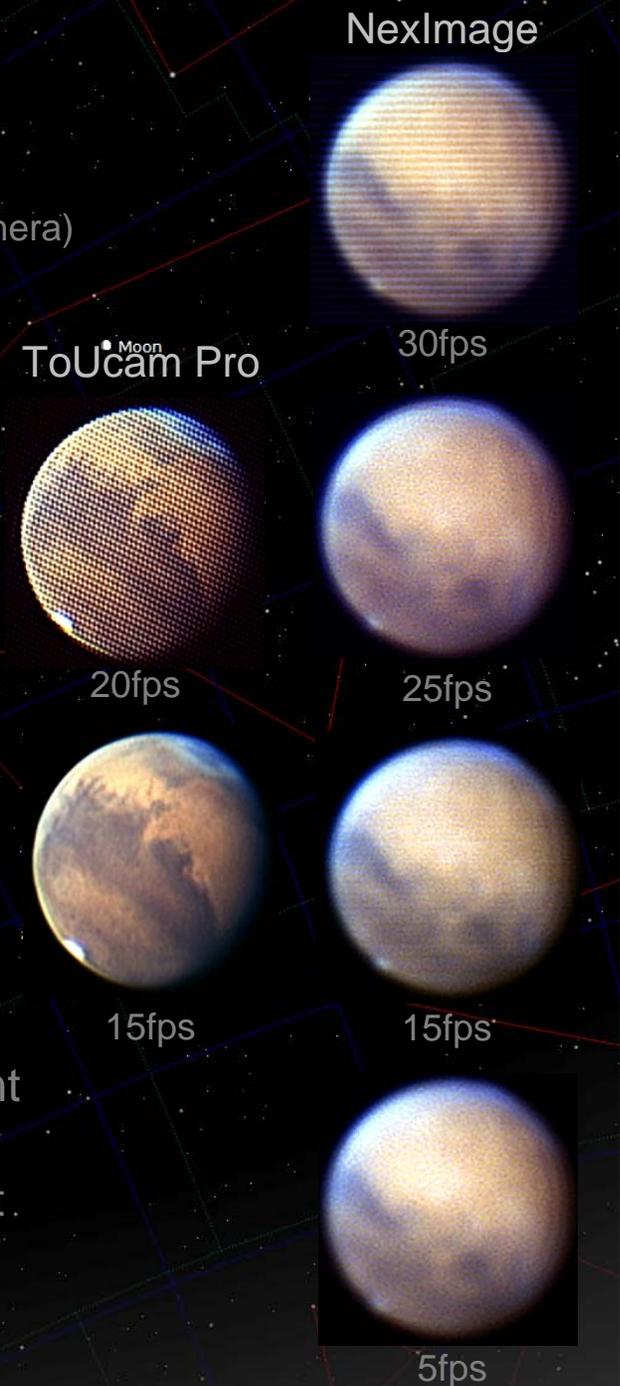
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- Noise issue



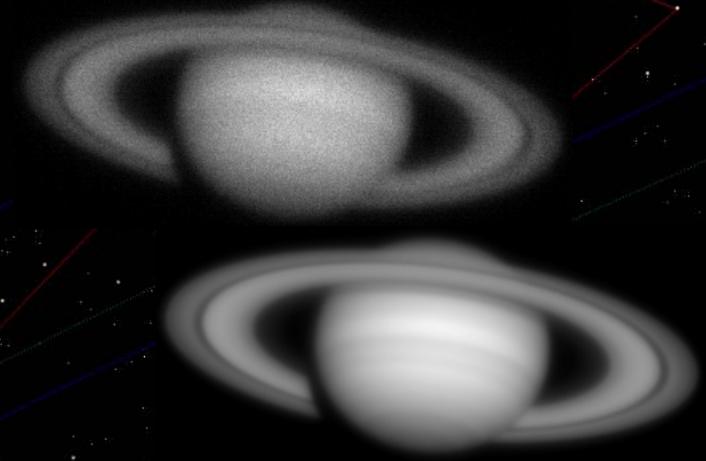
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- Noise issue
 - Some cameras have different levels of noise at different fps (even at slower rates)
 - Take several test shots with your camera, pick the best exposure and frame rate after processing.



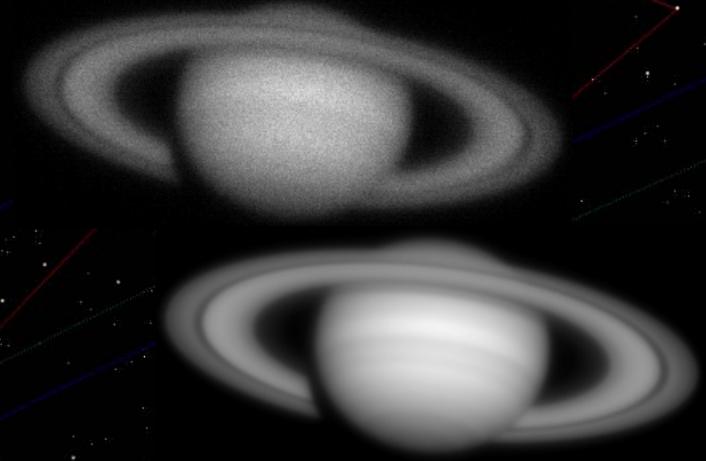
How Many Frames to Capture

- Why capture large numbers of frames to begin with?
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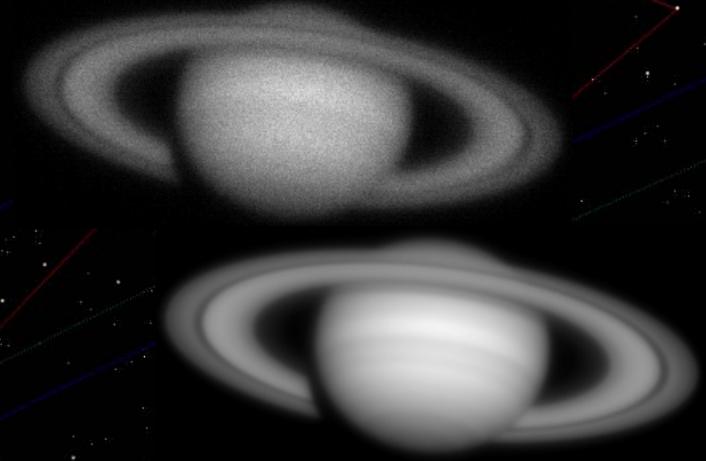
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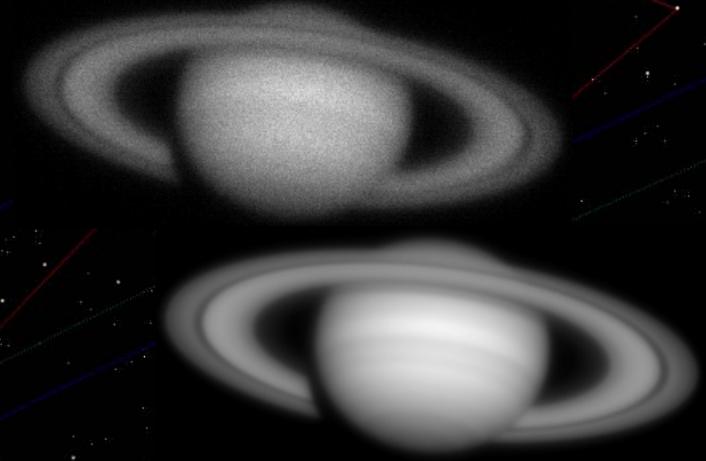
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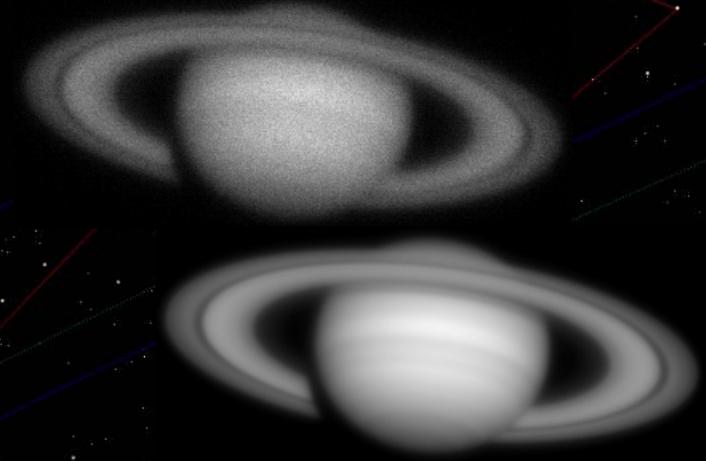
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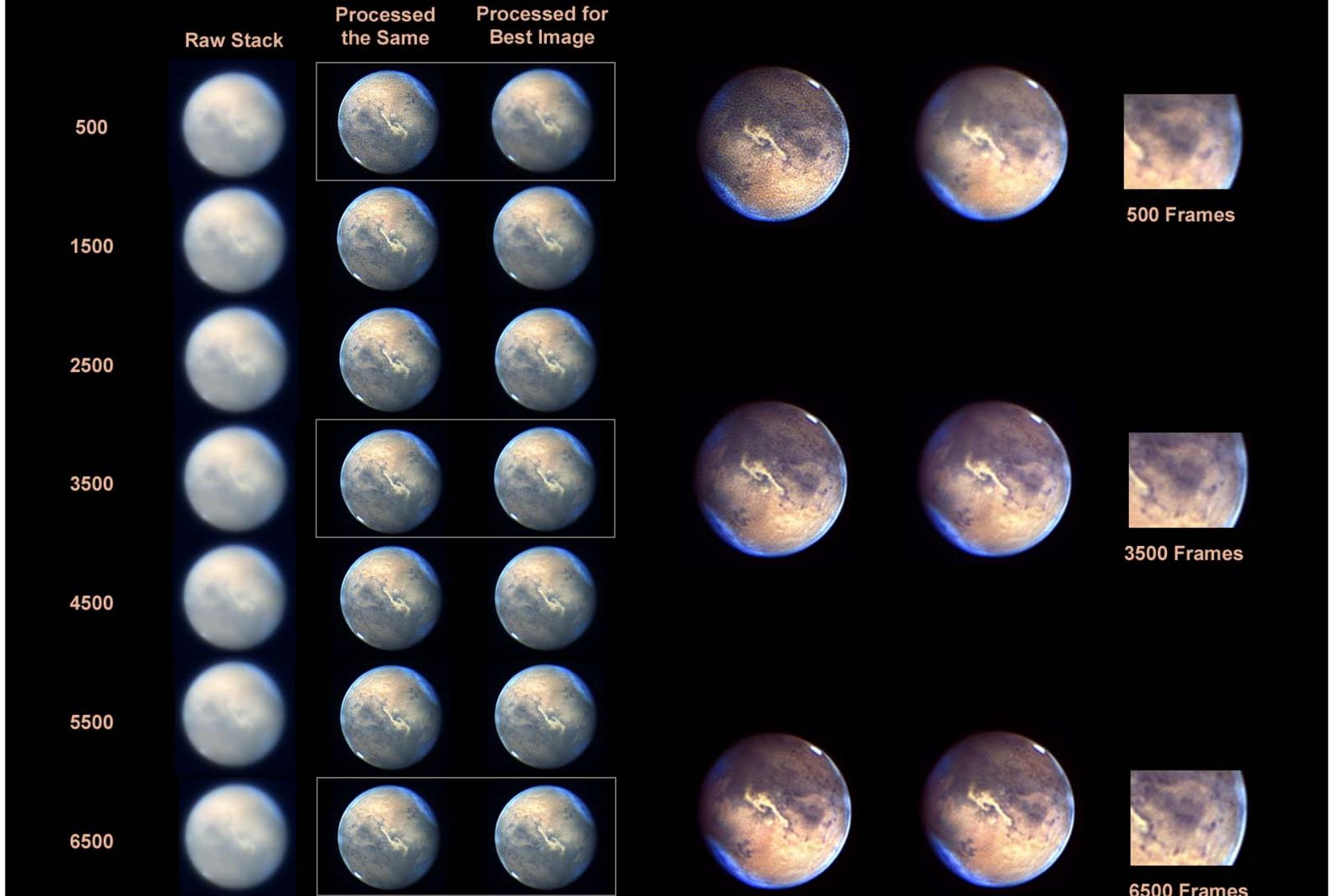


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 - High sensitivity
 - High frame rates



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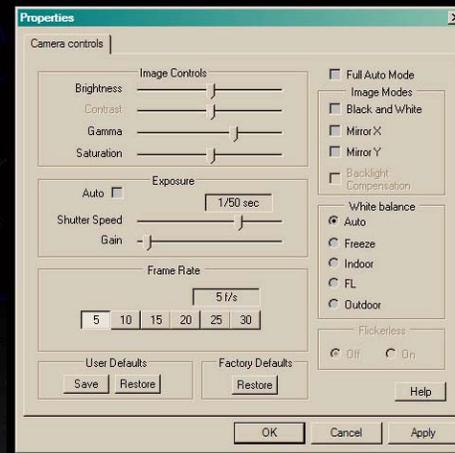
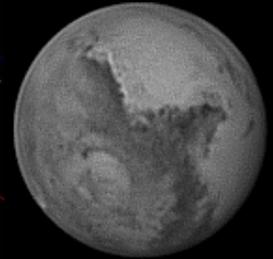
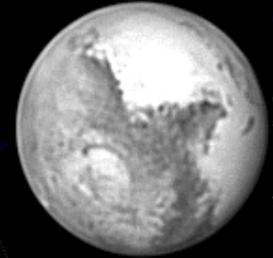


Exposure, Gain & White Balance

- It's not a good idea to use the camera's auto exposure setting
 - Use manual camera settings for better control

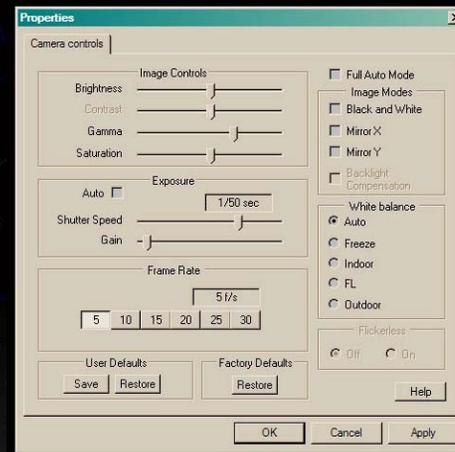
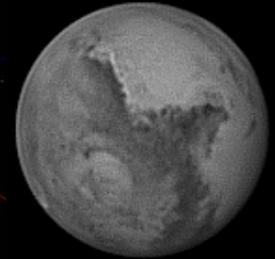
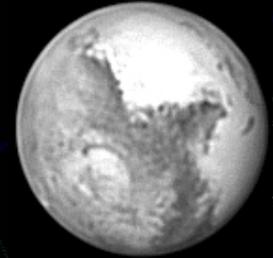
- Exposure and gain settings go hand in hand

- White balance seems to work best in "automatic" mode



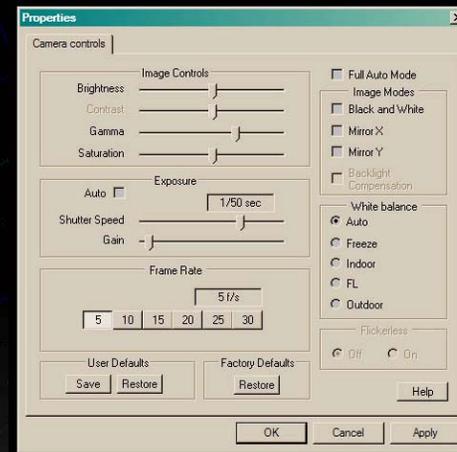
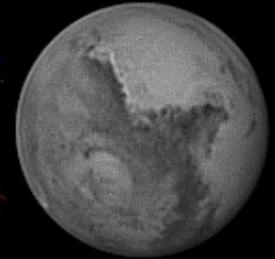
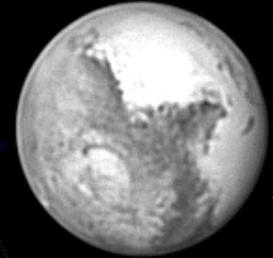
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- White balance seems to work best in "automatic" mode
 - Experiment with color settings
 - A pale under colored video image can easily be enhanced later
 - Images saturated with color tend to be difficult or impossible to correct



Processing



Processing Strategies

• Processing Software

- RegiStax V3 (aligning, stacking, initial proc)
- MaximDL (color combining)
- WinJupos (planetary ephemeris)
- Photoshop CS (luminance stacking, final proc)

• Things to consider

- Acquisition strategy
 - Somewhat determines the processing strategy
 - Longer sets taken? (may need to feature align)
 - Luminance filter sequences taken?

• Raw image quality

- Reference frame selection
- Frame rejection strategy

• Monochrome cameras

WinJUPOS - Database for Object Positions on Jupiter

Program Recording Lists Analysis Administration Tools Window Help

Ephemerides of Jupiter 2006-06-28 02:27.0

Date: 2006-06-28 Wednesday UT: 02:27.0 Geographic longitude: +015°00' Geographic latitude: +50°00'

Time control: -10 -1 Real time +1 +10 minutes Animation: Real time

System	I	II	III	Altitude
C. M.	196.1°	92.4°	245.9°	-24°
20h	320.1	218.5	11.9	Jupiter rise
21h	356.7	254.8	48.2	culmin.
22h	33.3	291.0	84.5	set
23h	69.9	327.3	120.7	Sun rise
0h	106.4	3.6	157.0	set

Apparent tropocentric coordinates (Equinox of date)

Right asc. 14h 28m 17.2s 217.072°
Hour angle 7h 22m 55.5s 110.731°
Declination -13° 25' 6" -13.418°

Astrometric tropocentric coordinates (Equinox J2000)

Right asc. 14h 27m 55.3s 216.980°
Declination -13° 23' 13" -13.387°

Altitude Azimuth : -24° 97° [W]

Jupiter rise : 14 h 4 min UT
culmin. : 19 h 1 min UT
set : 0 h 2 min UT

Sun rise : 2 h 53 min UT
set : 19 h 13 min UT

Elongation : 122.8° [E]
Light-time : 39.9 min
Diameter (phase corrected) : 40.9" equat.
Position angle : 19.58" equat.
Equ. phase angle : -9.1" f. limb
Visual magnitude : -2.3 mag
Declin. of Sun : -3.1°
Earth : -3.1°, b° -3.6°

JD : 2453914.60208

System 1 System 2 System 3

RegiStax processing AVI: C:\Documents and Settings\Larry Owens\My Documents\110750_1c_15ps_3.avi

Project files: Select, Favorites, Imports, Save, Load, Save as, Cancel

Align: Use Color, Use Mask, Use Subtrajectory, Use Pathfind

Options: AutoAlign, AutoCrop, AutoScale, AutoStretch, AutoTrim, AutoZoom

Stack: Automatic, Manual, Local contrast, Local gamma

Align box: 32, 64, 128, 256, 512, 1024, 2048, 4096, 8192, 16384, 32768, 65536, 131072, 262144, 524288, 1048576, 2097152, 4194304, 8388608, 16777216, 33554432, 67108864, 134217728, 268435456, 536870912, 1073741824, 2147483648, 4294967296, 8589934592, 17179869184, 34359738368, 68719476736, 137438953472, 274877906944, 549755813888, 1099511627776, 2199023255552, 4398046511104, 8796093022208, 17592186044416, 35184372088832, 70368744177664, 140737488355328, 281474976710656, 562949953421312, 1125899906842624, 2251799813685248, 4503599627370496, 9007199254740992, 18014398509481984, 36028797018963968, 72057594037927936, 144115188075855872, 288230376151711744, 576460752303423488, 1152921504606846976, 2305843009213693952, 4611686018427387904, 9223372036854775808, 18446744073709551616, 36893488147419103232, 73786976294838206464, 147573952589676412928, 295147905179352825856, 590295810358705651712, 1180591620717411303424, 2361183241434822606848, 4722366482869645213696, 9444732965739290427392, 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77706755690400486718565843777734666262

Processing Strategies

• Processing Software

- RegiStax V3 (aligning, stacking, initial proc)
- MaximDL (color combining)
- WinJupos (planetary ephemeris)
- Photoshop CS (luminance stacking, final proc)

• Things to consider

• Acquisition strategy

- Somewhat determines the processing strategy
- Longer sets taken? (may need to feature align)
- Luminance filter sequences taken?

• Raw image quality

- Will determine alignment strategy
- And percentage of rejected frames

• Reference frame selection

• Frame rejection strategy

- Quality only
- Quality and alignment accuracy

• Monochrome cameras

- LRGB, process color sets before and after luminance set

WinJUPOS - Database for Object Positions on Jupiter

Program Recording Lists Analysis Administration Tools Window Help

Ephemerides of Jupiter 2006-06-28 02:27.0

Date: 2006-06-28 Wednesday UT: 02:27.0 Geographic longitude: +015°00' Geographic latitude: +50°00'

Time control: -10 -1 Real time +1 +10 minutes Animation: Real time

System	I	II	III	Altitude
C. M.	196.1°	92.4°	245.9°	-24°
20h	320.1	218.5	11.9	Jupiter rise
21h	356.7	254.8	48.2	culmin.
22h	33.3	291.0	84.5	set
23h	69.9	327.3	120.7	Sun rise
0h	106.4	3.6	157.0	set

Apparent tropocentric coordinates (Equinox of date)

Right asc. 14h 28m 17.2s 217.072°
Hour angle 7h 22m 55.5s 110.731°
Declination -13° 25' 6" -13.418°

Astrometric tropocentric coordinates (Equinox J2000)

Right asc. 14h 27m 55.3s 216.980°
Declination -13° 23' 13" -13.387°

Altitude Azimuth : -24° 97° [W]

Jupiter rise : 14 h 4 min UT
culmin. : 19 h 1 min UT
set : 0 h 2 min UT

Sun rise : 2 h 53 min UT
set : 19 h 13 min UT

Elongation : 122.8° [E]
Light-time : 39.9 min
Diameter (phase corrected) : 40.9" equat.
Position angle : 19.58" equat.
Equ. phase angle : -9.1" f. limb
Visual magnitude : -2.3 mag
Decl. of Sun : -3.1°
Earth : -3.1°, b° -3.6°

JD : 2453914.60208

System 1 System 2 System 3

RegiStax processing AVI: C:\Documents and Settings\Larry Owers\My Documents\Tolken\stars_110750_1c_15ps_3.avi

Project files: Save Load Save as

Align: Select Features Images

Options: Use Color Use LRGB Use Substratify Use Partial Use Preprocessed Use Automatic Use Reference Library Use Local Contrast Use Zoom Use Show Use Retain

Processing: Area 812 Pixels # 128 Zoom

Alignment box: # 32 # 256 # 64 # 512

Quality estimate: Local contrast %

Show negative image (only during selection) Frame (2392): 2392/4574

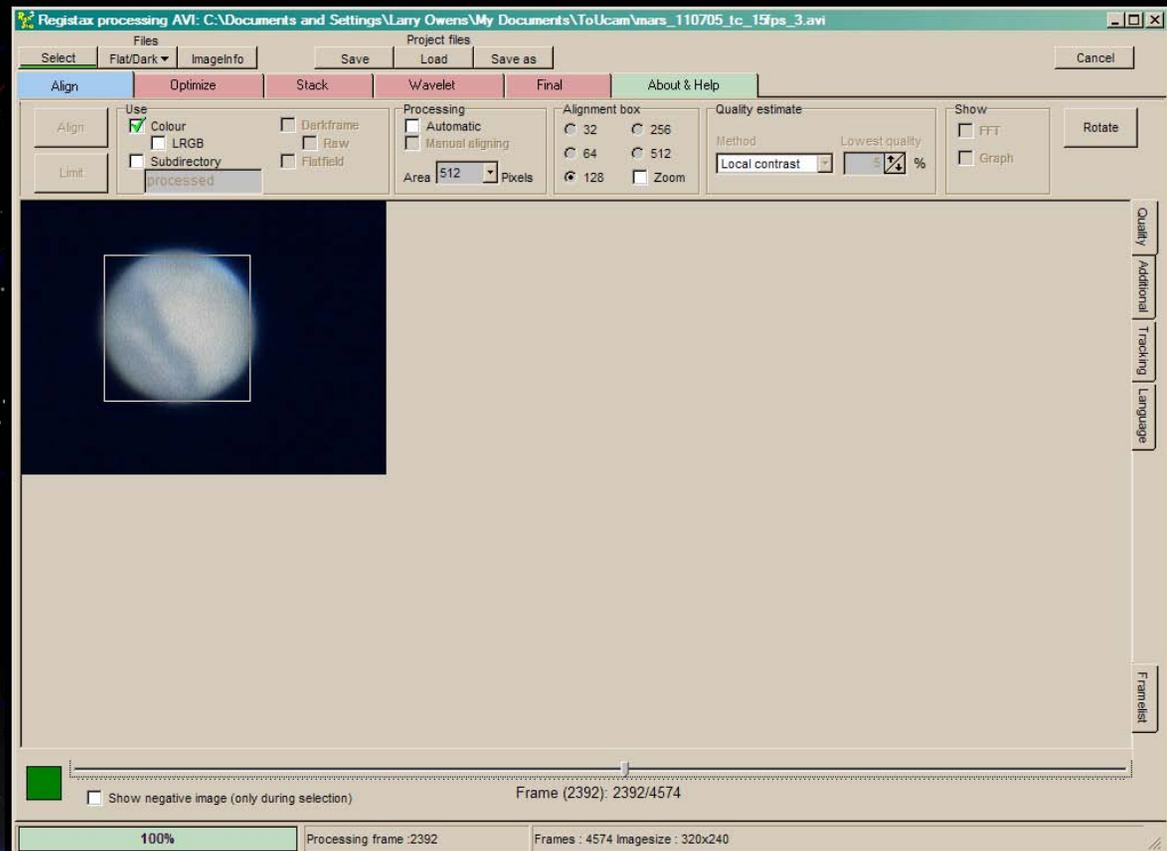
100% Processing frame 2392 Frames: 4574 Images: 120x240

Processing Workshop



Reference Frame Selection

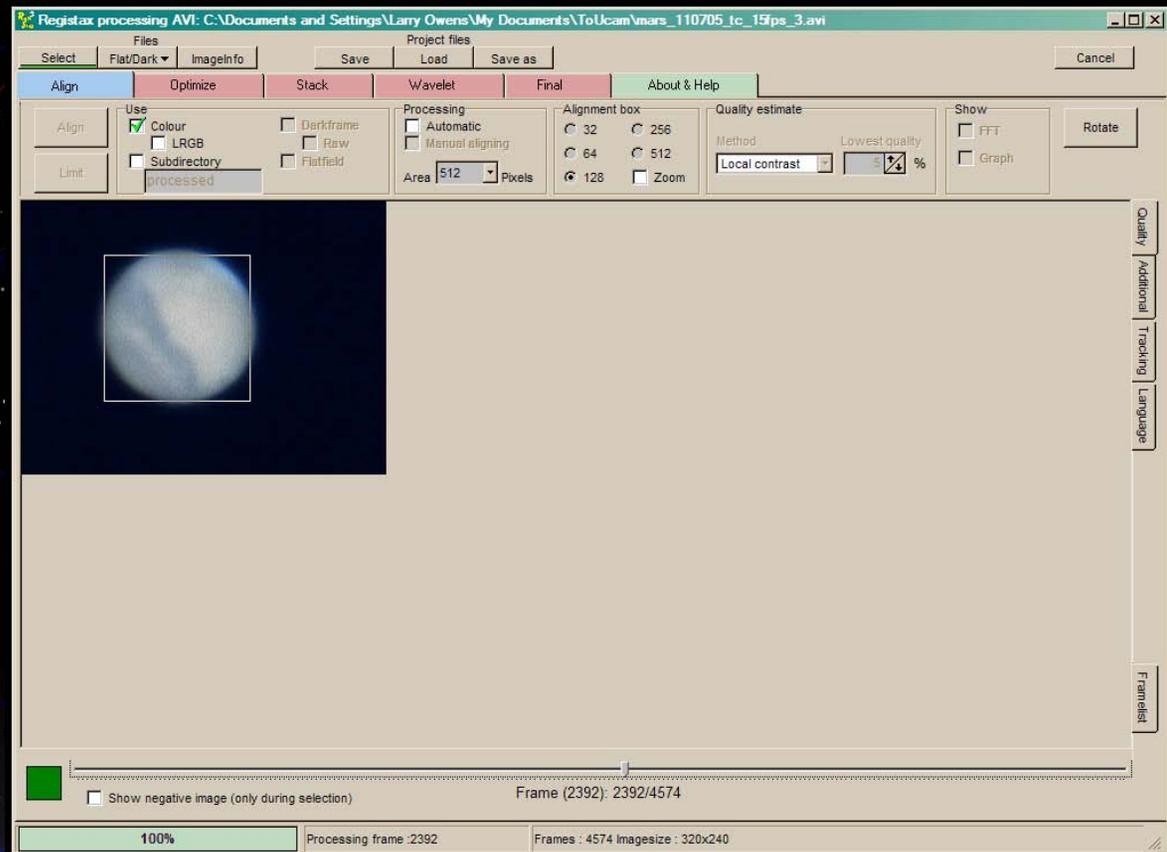
- Reference frame becomes the model for Alignment and Alignment Optimization
 - Selecting an “average” frame seems to work best
 - An average frame produces a flatter alignment curve (important later)
 - A frame from the middle of the AVI reduces planetary rotation artifacts (unless aligning by planetary feature)



Reference Frame Selection

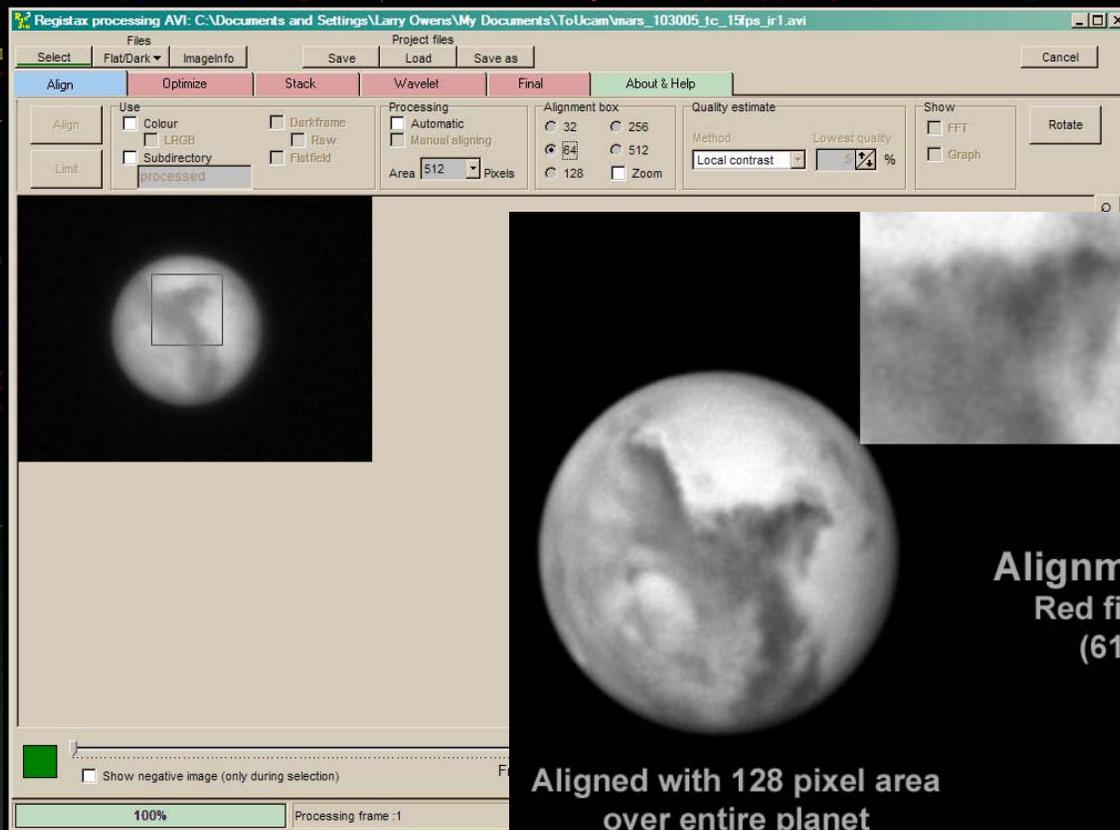
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Select Reference Frame



Alignment Box Size

- There are 2 options with planets
 - Align the entire planet
 - Planetary rotation affects central detail
 - Align on a feature of the planet
 - Use if there are high contrast features (best with Jupiter)
 - Better central detail, less limb detail



Aligned with 128 pixel area
over entire planet

Alignment Options
Red filtered image
(612-670nm)

Aligned with 64 pixel area
over Syrius Major

Quality Setting, Alignment Optimization

- Better results are obtained when you take some manual control
 - Pick a low “Lowest Quality” number or even 0
 - Quality setting limits frames for you, but there are 2 other ways to do that
 - Use “Local Contrast” quality estimate method – others work well also
 - The FFT Spectrum value estimates are usually OK
 - Adjust filter until you see a single sizable red area in center

The screenshot displays the Registax software interface with the following components:

- Menu Bar:** Files, Project files, Save, Load, Save as, Cancel.
- Toolbars:** Align, Optimize, Stack, Wavelet, Final, About & Help.
- Processing Options:**
 - Use: Colour, LRGB, Subdirectory, Darkframe, Raw, Flatfield, Processed.
 - Processing: Automatic, Manual aligning.
 - Alignment box: 32, 256, 64, 512, 128, Zoom.
 - Area: 512 Pixels.
- Quality Estimate:** Method: Local contrast, Lowest quality: 54%.
- Show:** FFT, Graph, Rotate.
- Initial optimizing run:** Quality = 1122.69900, red line = power spectrum.
- FFT spectrum 128x128:** A heatmap showing a central red area surrounded by green and yellow.
- Quality settings:**
 - Classic: 4%, 5%
 - Human Visual: 4%
 - Compression: 60%
 - Autofilter
 - Manual, Recalc FFT, FFTfilter: 3
- Status Bar:** Frame (1): 1/4597 (stacksize 1), 100%, Processing frame :1, Frames : 4597 Imagesize : 320x240.

Quality Setting, Alignment Optimization

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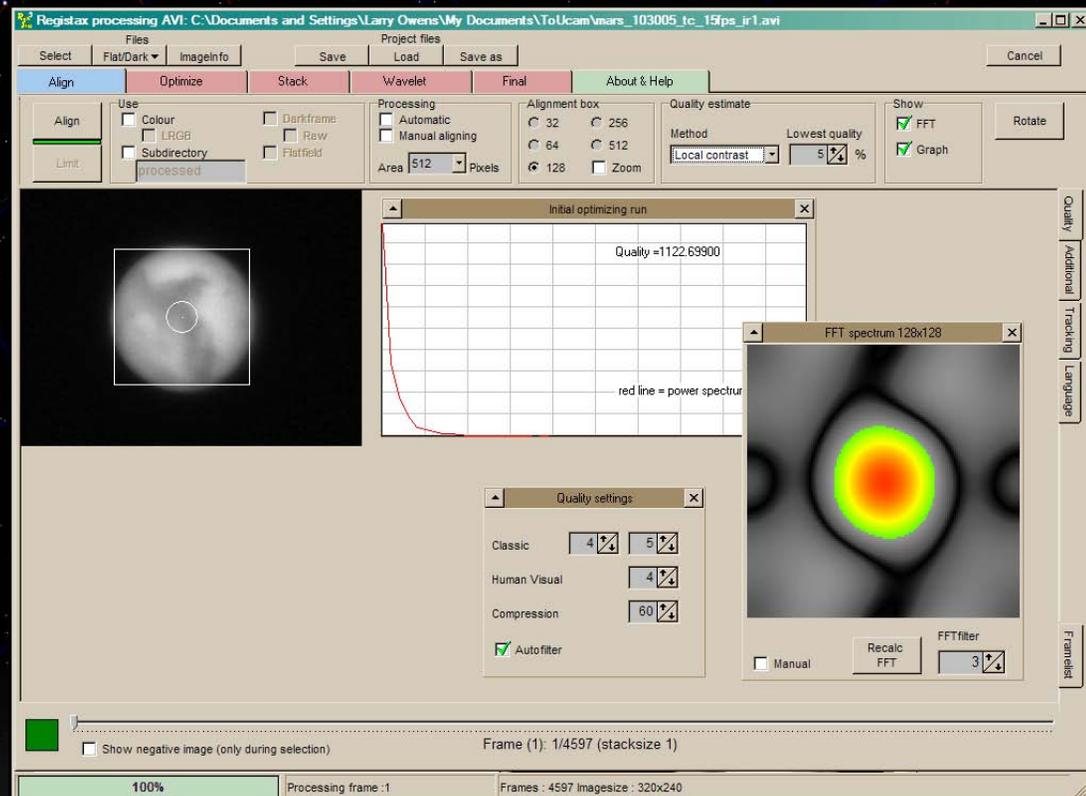
Select Alignment Box Size

Select “Local Contrast”

Select “0” Lowest Quality

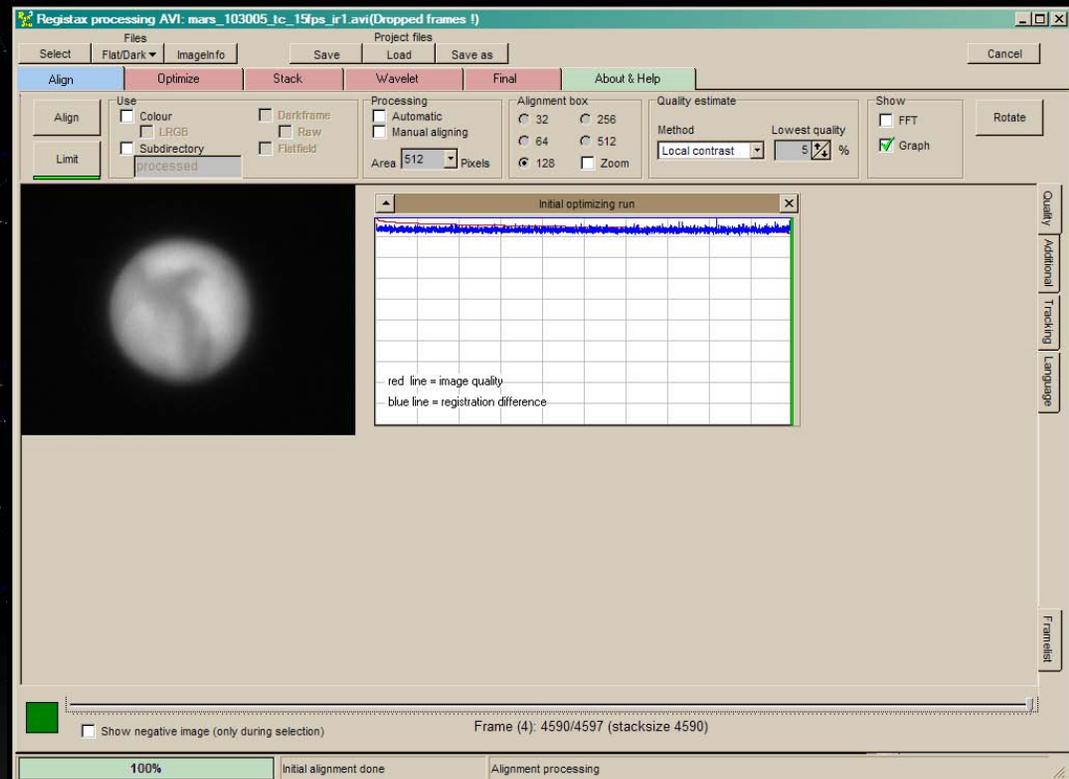
Adjust FFT Filter

Press “Align”



Quality Setting, Alignment Optimization

- Evaluate initial alignment curve (blue curve)
 - If not relatively flat, select a different reference frame
 - We are looking for the “average” alignment of most frames
 - This will enable us to select a larger number of similarly aligned frames
- The “Limit” button is just a time saver
 - Allows exclusion of very low quality frames before alignment optimization
 - Use frame slider to exclude frames



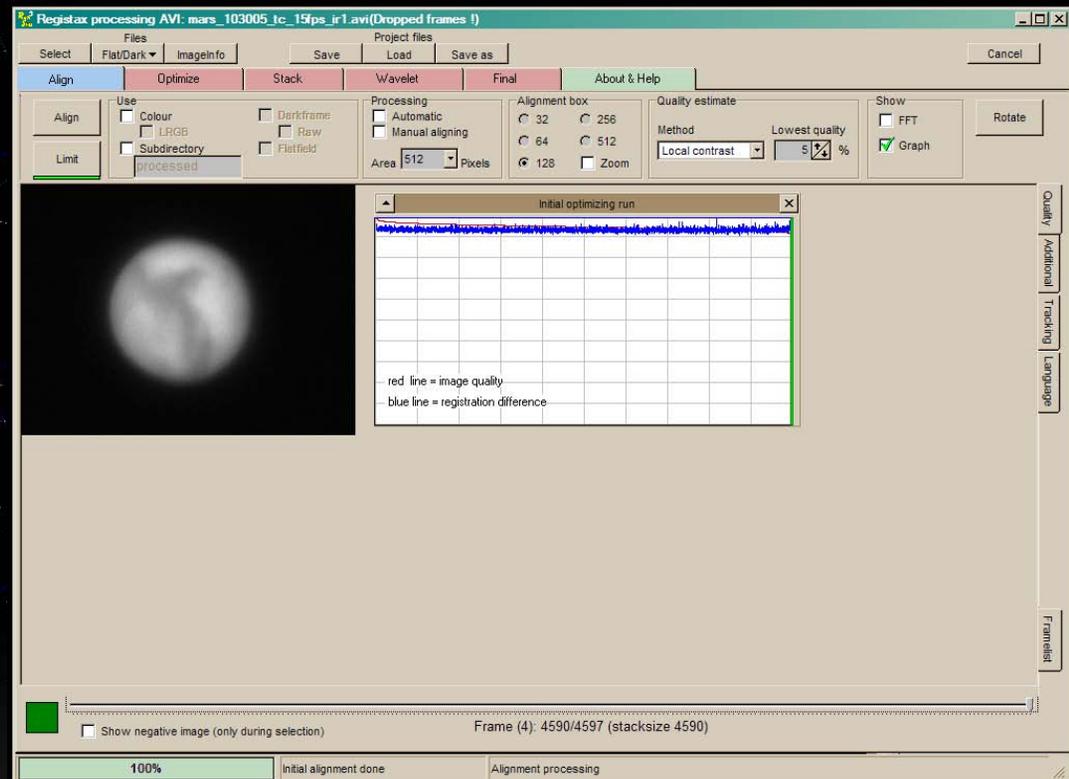
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If “alignment curve” is OK

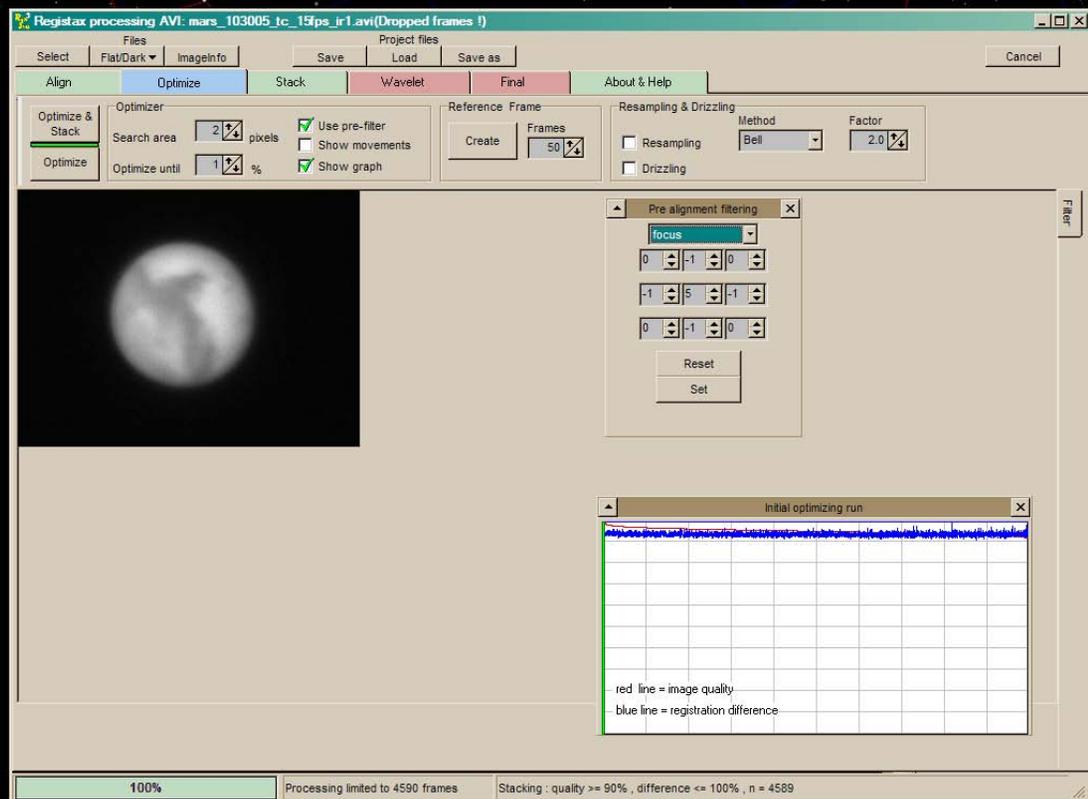
Press “Limit”

WAIT - DO NOT PRESS
Optimize and Stack!



Alignment Optimization

- After pressing “Limit” you have more options
 - Don't use “Optimize and Stack” - more selecting to do
 - Optimize until - sets optimization limits
 - Reference frame – gives you the option to create a perfect frame for alignment optimization (not recommended)
 - Resampling and Drizzling – allows each frame to be “enlarged” before alignment optimization and stacking (not recommended)
 - Use Pre-filter – enhances each frame before optimization (NexImage)



Alignment Optimization

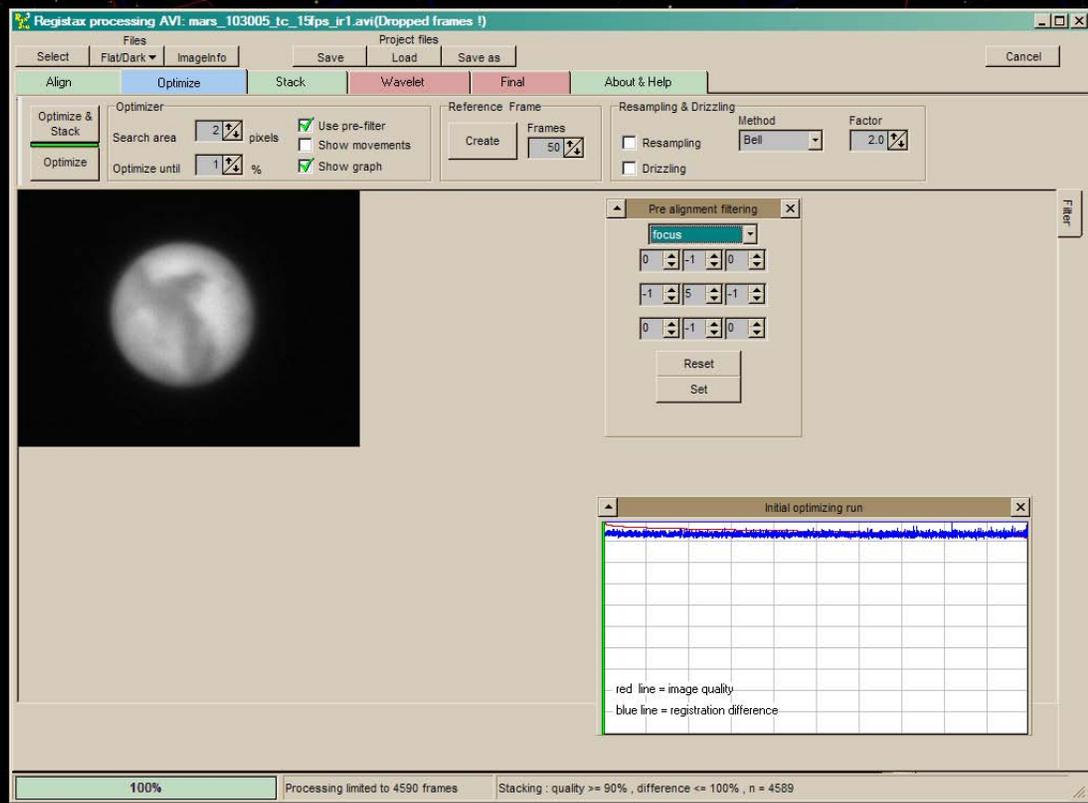
- After pressing “Limit” you have more options
 - Don’t use “Optimize and Stack” - more selecting to do
 - Optimize until - sets optimization limits
 - Reference frame – gives you the option to create a perfect frame for alignment optimization (not recommended)
 - Resampling and Drizzling – allows each frame to be “enlarged” before alignment optimization and stacking (not recommended)
 - Use Pre-filter – enhances each frame before optimization (NexImage)

Select Optimize until 1%

Press “Optimize”

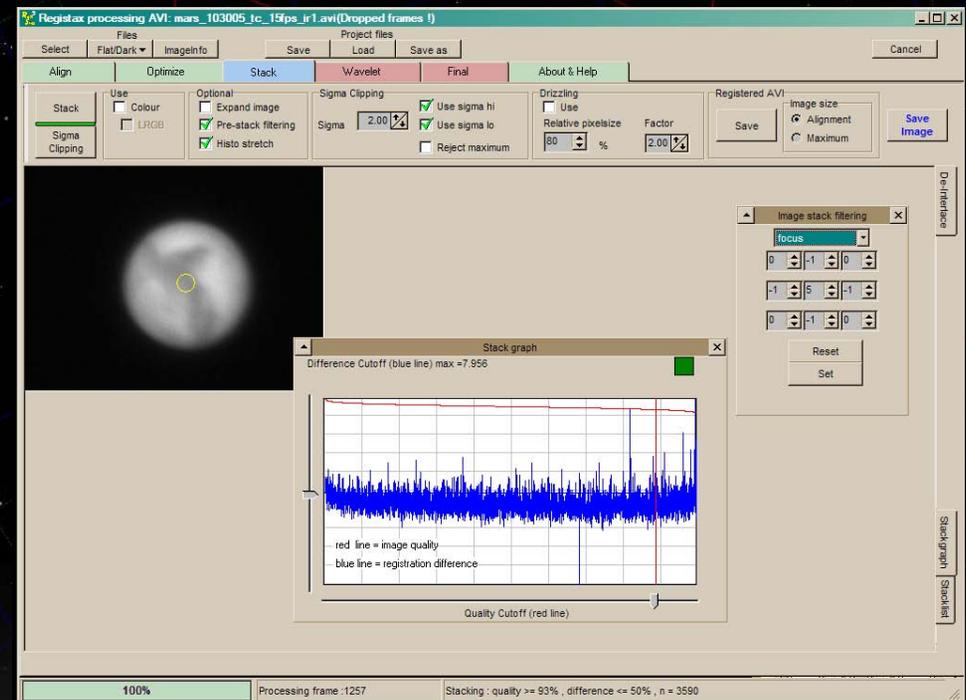
Wait for completion...

Press the Green “Stack” tab (top)



Final Frame Selection, Stacking

- When alignment optimization is complete
 - The “Stack graph” (tab on the lower right) is key to fine tuning stacking
 - Vertical axis is used to select frames based on alignment (relative to ref frame)
 - Flat curve allows more “alike” frames to be stacked (exclude 10-30%)
 - Horizontal axis is used to select frames based on quality (exclude 10-20%)
 - Exclude more frames with bad seeing – Experiment!
 - Some cameras benefit from using the “Focus” pre-stack Filter (NexImage)
 - “Histo stretch” expands the number of colors or levels of gray to 32bits



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 - “Histo stretch” expands the number of colors or levels of gray to 32bits

Select “Stack Graph” tab

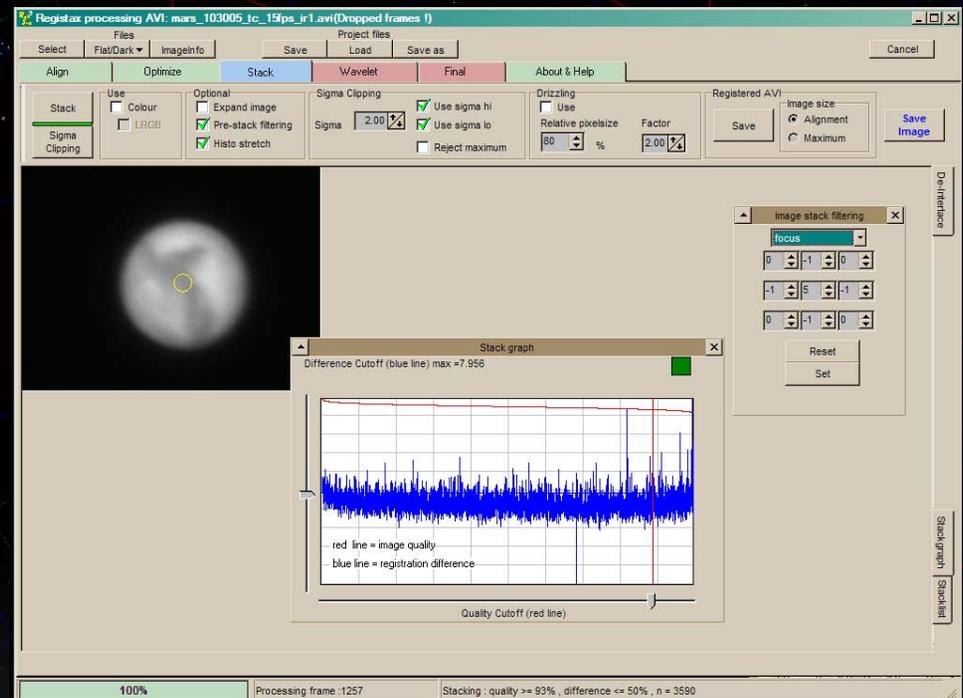
Exclude 10-30% of frames by alignment deviation (vertical bar)

Exclude 10-30% lowest quality frames (horizontal bar)

Select “Histo Stretch”

Select “Brightness equalization”

Press “Stack”



Wavelet Processing

- Press the “Wavelet” tab
 - Open “Histogram” and “Gamma”
 - Use histogram to prevent clipping and adjust color
 - Use gamma to enhance contrast
 - Wavelet enhancement
 - 1:1 slider – fine details
 - 6:1 slider – large details
- Save images in a 16-bit format for further processing in PhotoShop
 - PNG or TIFF

The screenshot displays the RegiStax processing software interface, which is used for processing astronomical images. The main window is titled "RegiStax processing AVI: mars_103005_tc_15fps_ir1.avi(Dropped frames 1)". The interface is divided into several panels and tabs.

Wavelet Panel: This panel is currently active and shows the "Wavelet" tab. It includes a "Process" button, "Realign with Processed" and "Reset" options, and a "Wavelet scheme" section with radio buttons for "Dyadic (2^n)" and "Linear". Below this, there are settings for "Initial Layer" (1), "Step" (1), and "Increment" (0). The "Wavelet filter" is set to "Default", and the "Wavelet centre" is 50. A list of wavelet layers is shown with checkboxes and sliders: 1:1 (100), 2:1 (29.3), 3:1 (1), 4:1 (1), 5:1 (7.8), and 6:1 (19.9). A "Preview" window shows a blurred image of the Moon. A "Histogram graph" window is also visible, showing a plot of the image's intensity distribution with a peak at 255 and a trough at 0. A "Gamma" window is open, showing a linear graph with a "Gamma (overrules graph)" value of 1.00.

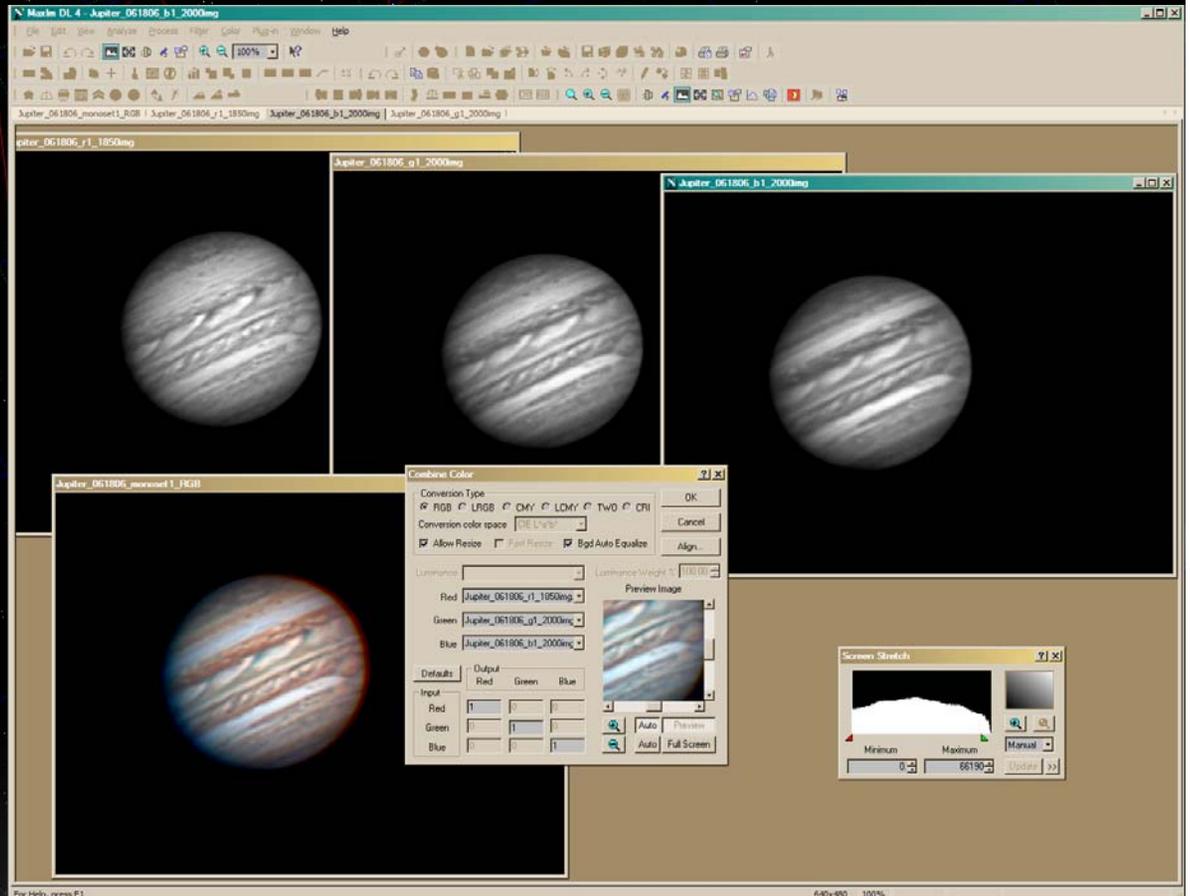
Histogram Panel: This panel shows the "Histogram graph" window, which displays a plot of the image's intensity distribution. The x-axis represents intensity from 0 to 255, and the y-axis represents frequency. The plot shows a sharp peak at 255 and a trough at 0. The "Histogram graph" window has a "Show peak" checkbox (checked) and a "Smooth" checkbox (checked). It also has "Colourweight" sliders for Red, Green, and Blue, all set to 1.00. "Stretch" and "Reset" buttons are at the bottom.

Gamma Panel: This panel shows the "Gamma" window, which displays a linear graph. The x-axis represents intensity from 0 to 255, and the y-axis represents intensity from 0 to 255. A diagonal line represents the gamma function. The "Gamma (overrules graph)" value is 1.00. The "Gamma" window has "Load" and "Reset" buttons.

Other Panels: The interface includes a "Files" menu, "Project files" section, and "About & Help" tab. The "Process" button is labeled "Do All". The "Wavelet" tab is selected, and the "Gamma" tab is also visible.

Color Combining (MaximDL)

- Open RED, GREEN and BLUE filtered images
 - Move “Screen Stretch” to maximum for each image
 - Convert to monochrome
 - Color Combine
 - Select RGB process
 - Select Red, Green and Blue files
 - Align
 - Color Combine
 - Save color RGB image
 - 16 bit format – TIFF
- Next stop: PhotoShop



PhotoShop and Final Image Prep

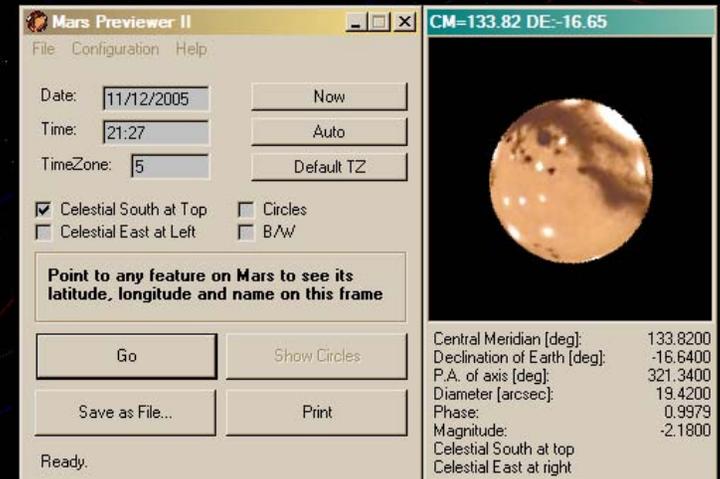
- PhotoShop CS or PhotoShop Elements

- Frequently used Features

- Levels
- Unsharp Mask
- Gaussian Blur
- Noise
- Polygon Tool
- Selection Feathering
- Brightness/Contrast
- Hue/Saturation
- Color Balance
- Selective Color
- Mode
- Image Size
- Rotate Canvas
- Layers – Lum Layering
- Text Tool

- Planetary Data

- WinJupos
- Mars Previewer II



Mars Previewer II

File Configuration Help

Date: 11/12/2005 [Now]
Time: 21:27 [Auto]
TimeZone: 5 [Default TZ]

Celestial South at Top Circles
 Celestial East at Left B/W

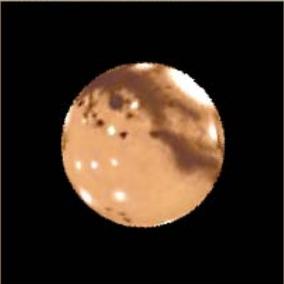
Point to any feature on Mars to see its latitude, longitude and name on this frame

Go Show Circles

Save as File... Print

Ready.

CM=133.82 DE=-16.65



Central Meridian [deg]:	133.8200
Declination of Earth [deg]:	-16.6400
P.A. of axis [deg]:	321.3400
Diameter [arcsec]:	19.4200
Phase:	0.9979
Magnitude:	-2.1800
Celestial South at top	
Celestial East at right	

PhotoShop and Final Image Prep

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- Planetary Data

- WinJupos
- Mars Previewer II

The screenshot shows two software windows. The top window is 'Mars Previewer II' with a title bar 'CM=133.82 DE=-16.65' and a central image of Mars. The bottom window is 'WinJupos - Database for Object Positions on Jupiter' with a title bar 'Ephemerides of Jupiter 2006-06-28 02:27.0'. It displays various astronomical data for Jupiter and the Sun.

Mars Previewer II Data:

- Central Meridian [deg]: 133.8200
- Declination of Earth [deg]: -16.6400
- P.A. of axis [deg]: 321.3400
- Diameter [arcsec]: 19.4200
- Phase: 0.9979
- Magnitude: -2.1800
- Celestial South at top
- Celestial East at right

WinJupos Ephemerides of Jupiter 2006-06-28 02:27.0 Data:

Date: 2006-06-28 Wednesday UT: 02:27.0
Geographic longitude: +015°00' Geographic latitude: +50°00'

System	I	II	III
C.M.	196.1°	92.4°	245.9°

Time	Altitude	Azimuth
20h -	320.1	218.5
21h -	356.7	254.8
22h -	33.3	291.0
23h -	69.9	327.3
0h -	106.4	3.6

Jupiter rise: 14 h 4 min UT
Jupiter culmin.: 19 h 1 min UT
Jupiter set: 0 h 2 min UT

Sun rise: 2 h 53 min UT
Sun set: 19 h 13 min UT

Elongation: 122.8° [E]
Light-time: 39.9 min
Diameter (phase corrected): 40.9" equat.
Position angle: 19.58" equat.
Equ. phase angle: 338.6" horiz.
Visual magnitude: -9.1" f. limb
Declin. of Sun: -3.1" mag
Declin. of Earth: -3.1" b" -3.6"

Right asc. 14h 28m 17.2s 217.072°
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JD: 2453914.60208

PhotoShop and Final Image Prep

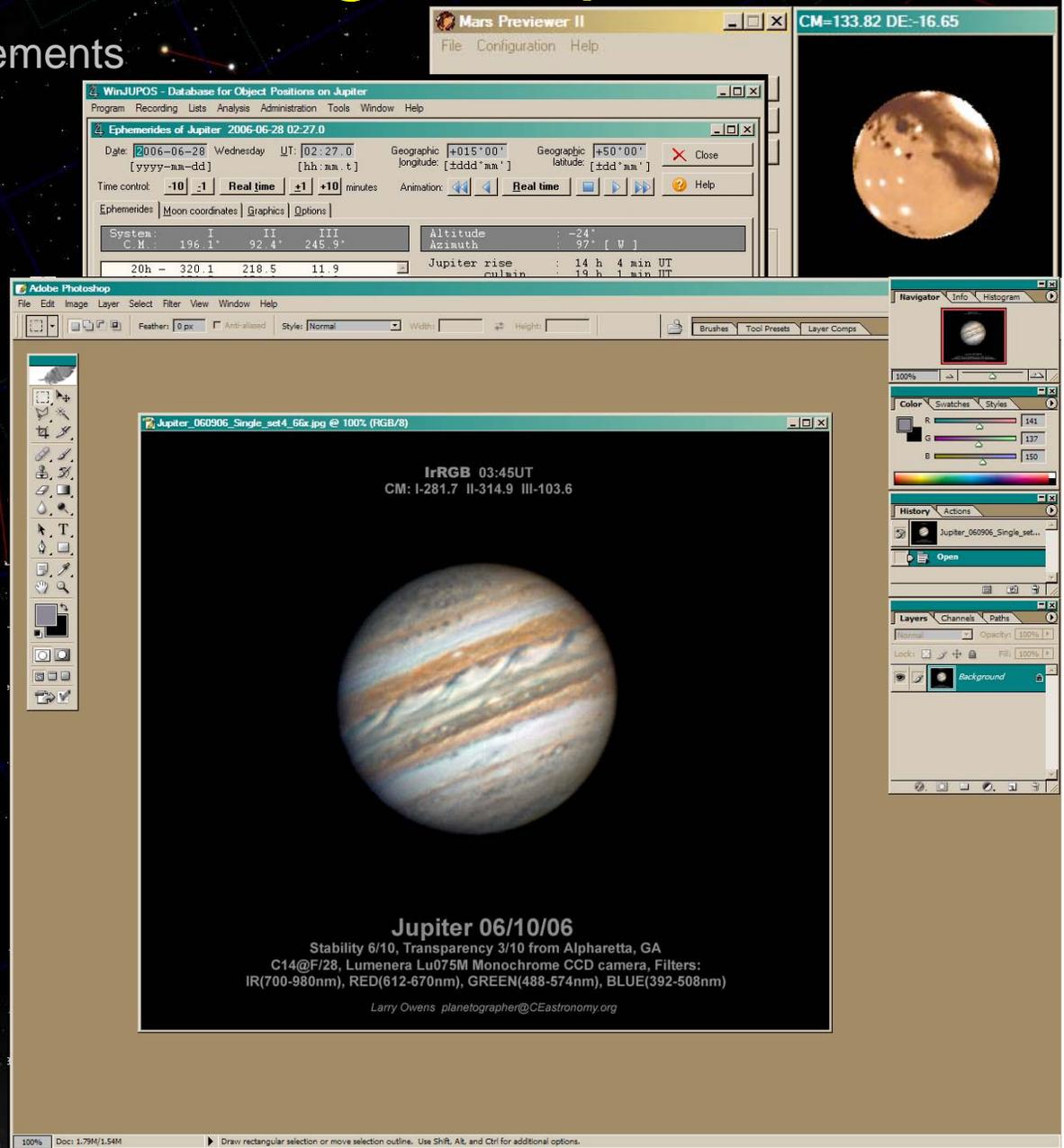
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- Planetary Data

- WinJupos
- Mars Previewer II



More Practice... PhotoShop, RegiStax, MaximDL

Questions

Suggestions

Comments

