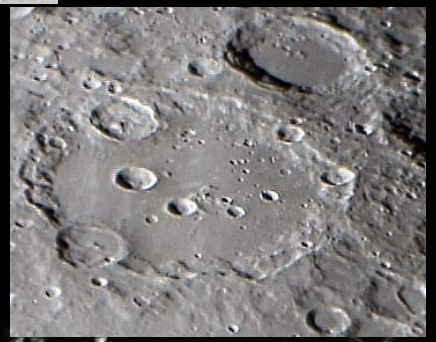
# Webcam & LPI Imaging


David Haworth

http://www.stargazing.net/david





# Philips 740 ToUcam & Meade LPI

## Orion 80mm Refractor 400mm Focal Length

**ToUcam**

**Meade LPI**

# Agenda

- It is all about stacking
- Camera Comparisons
- Philips PCVC740K ToUcam
- Meade Lunar Planetary Imager (LPI)

# Webcam AVI Movie

## Saturn ToUcam 740

# First 9 Images of 1400 Images

ToUcam 740

# 1024 Images Stacked Out of 1400

Saturn ToUcam 740

# Astroimaging Cameras Comparisons


35mm Film

ST-237 CCD


D70 Digital SLR

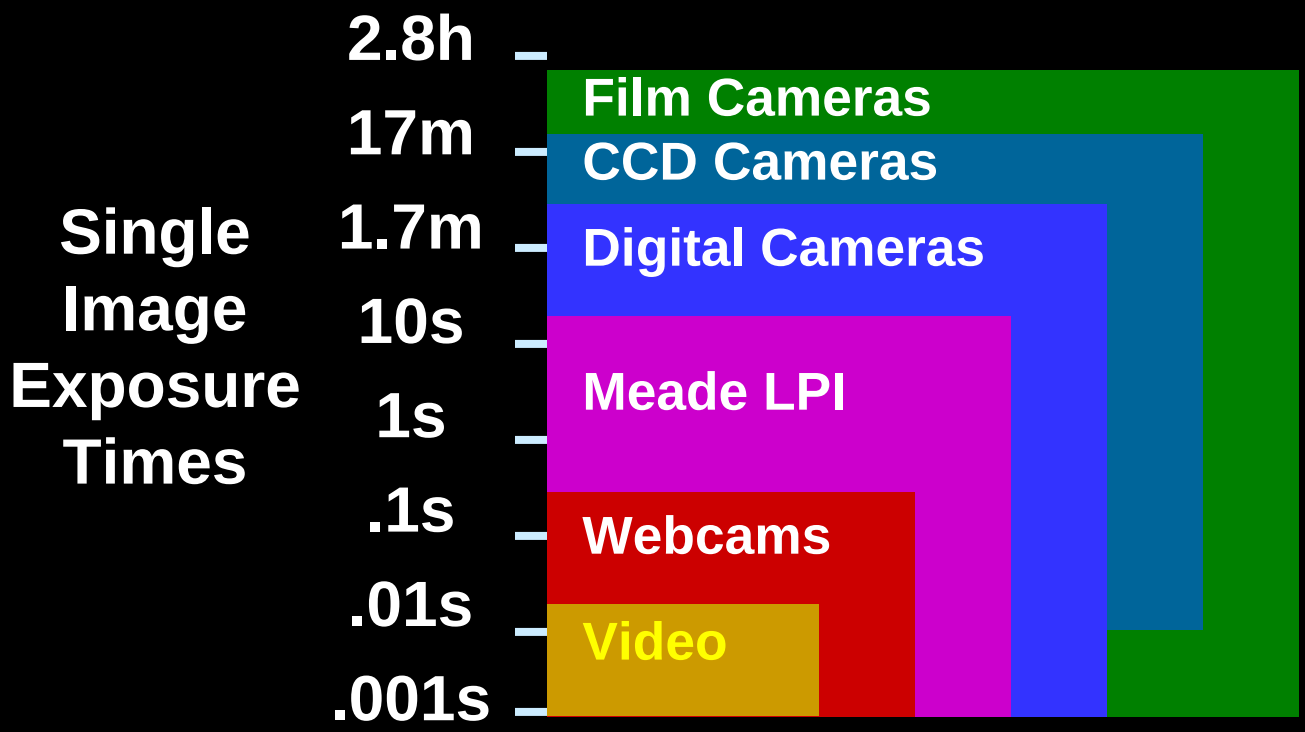

990 Digicam

740 Webcams

Meade LPI

# Camera Exposure Times

## Video Cameras



# Field of View (FOV)

## Focal Length Determines Image Size at Focal Plane

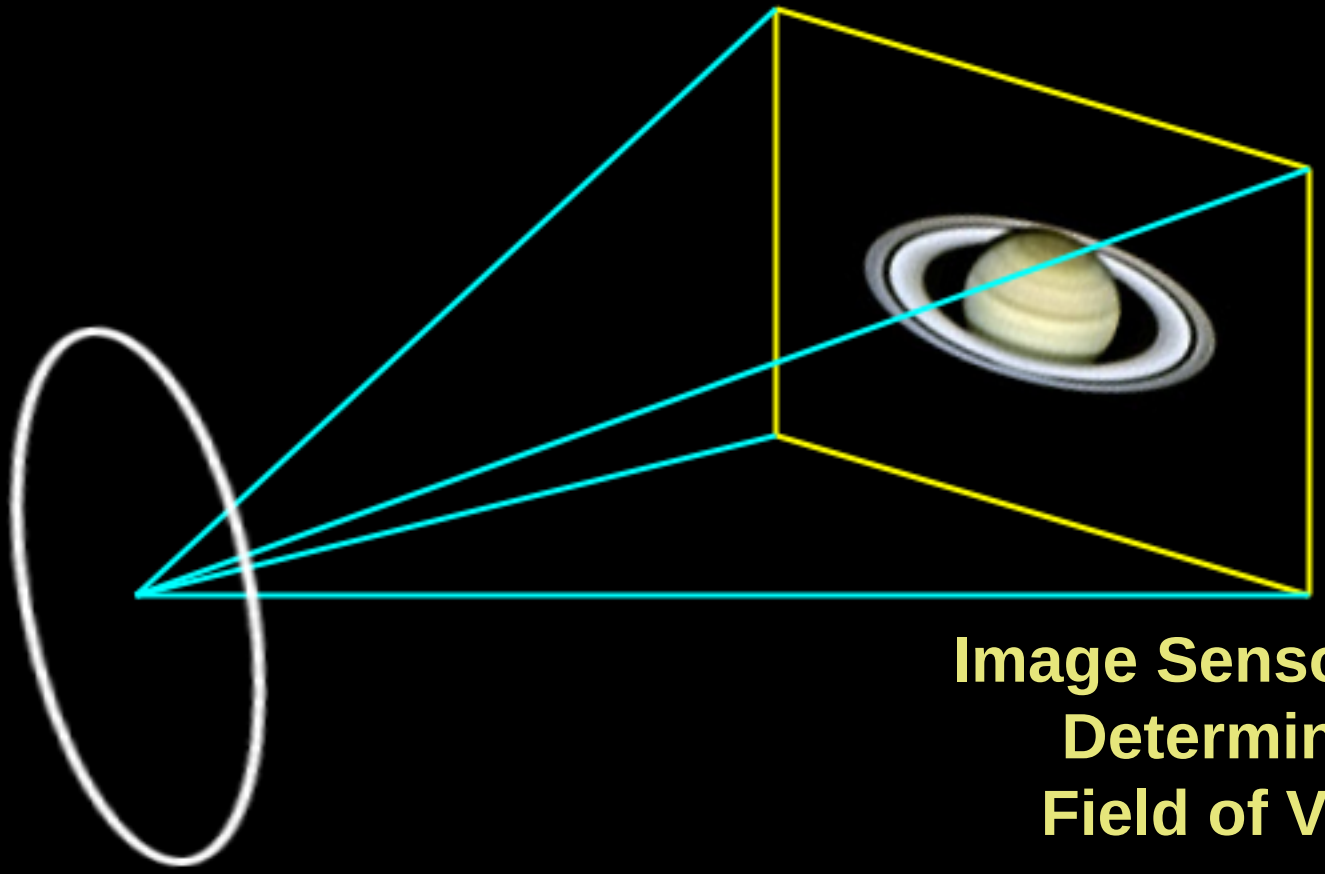
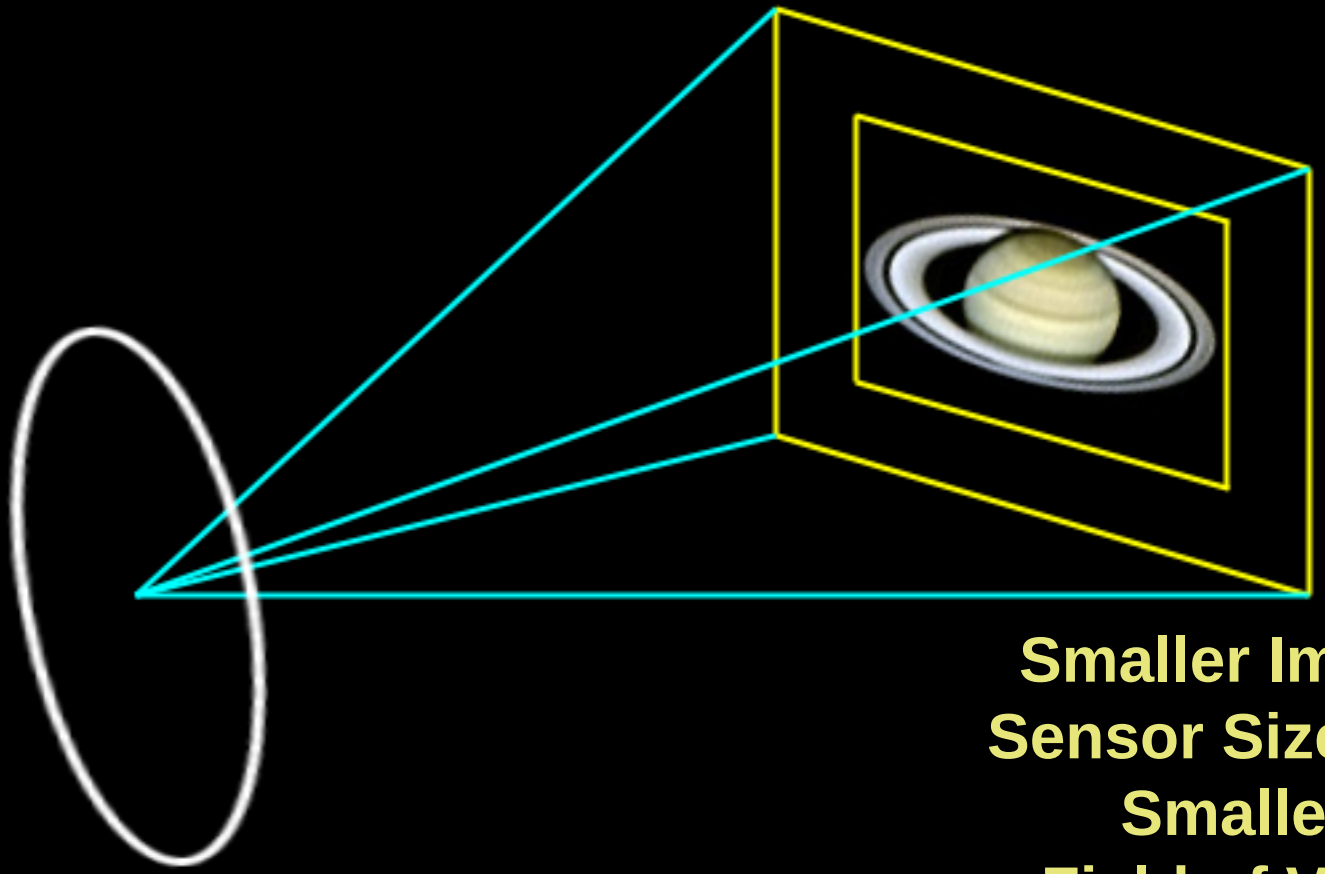


**Image Sensor Size Determines Field of View**

**Telescope Lens**

# Field of View (FOV)

## Focal Length Determines Image Size at Focal Plane



**Smaller Image Sensor Size Has Smaller Field of View**

**Telescope Lens**

# Cameras FOV Comparisons

## Using Orion 80mm Refractor 400mm Focal Length


**35mm Film**

**ST-237 CCD**


**D70 Digital SLR**

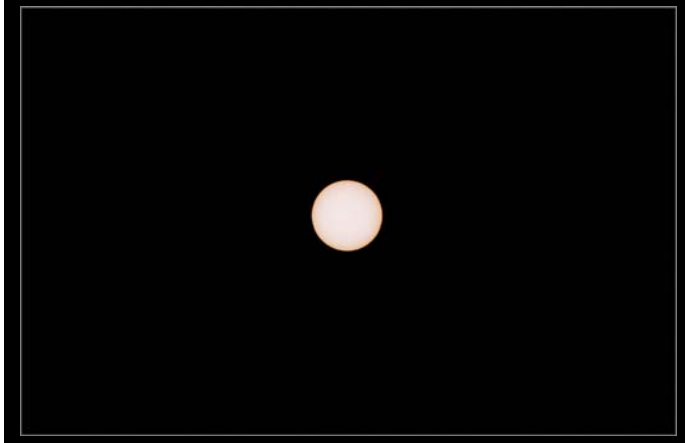

**990 Digicam**

**740 Webcams**

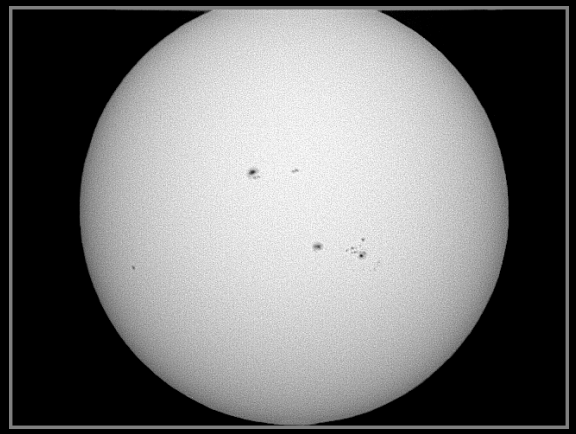
**Meade LPI**

# Cameras FOV Comparisons

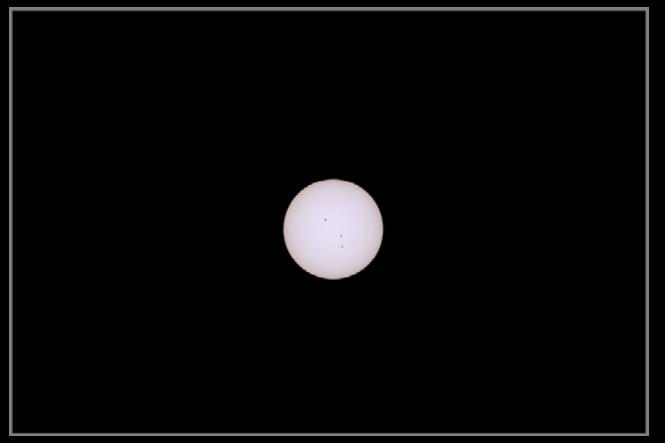
## Using Orion 80mm Refractor 400mm Focal Length



35mm Film



ST-237 CCD



D70 Digital SLR

990 Digicam

740 Webcam

Meade LPI

# Nikon D70 FOV

## Using Orion 80mm Refractor 400mm Focal Length


**Digital SLR**
**640 x 480**
**crop**

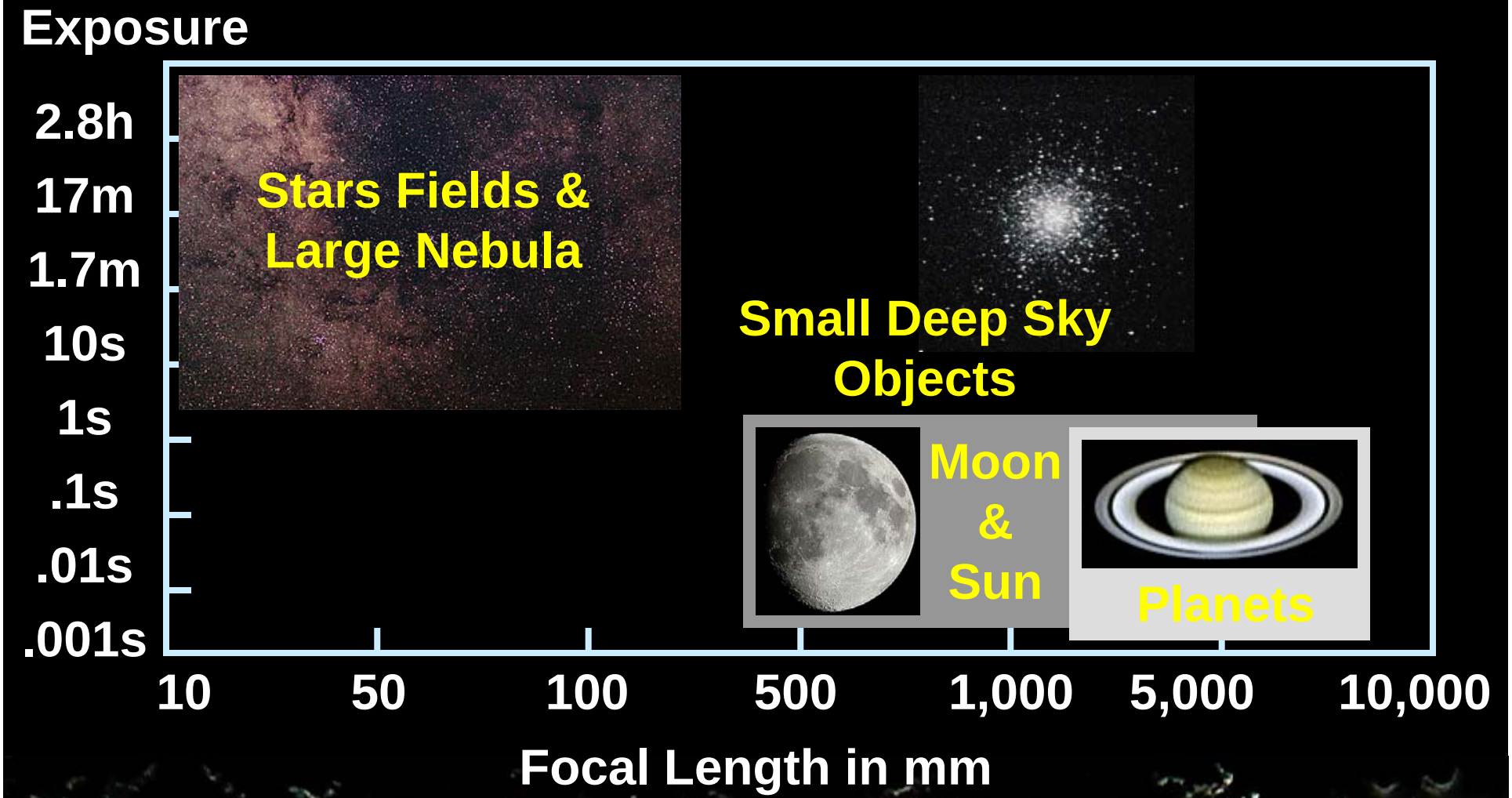
# Nikon 990 FOV

## Using Orion 80mm Refractor 400mm Focal Length


**Digicams**
**Nikon 990**
**afocal with**
**14mm eyepiece**
**640 x 480 crop**

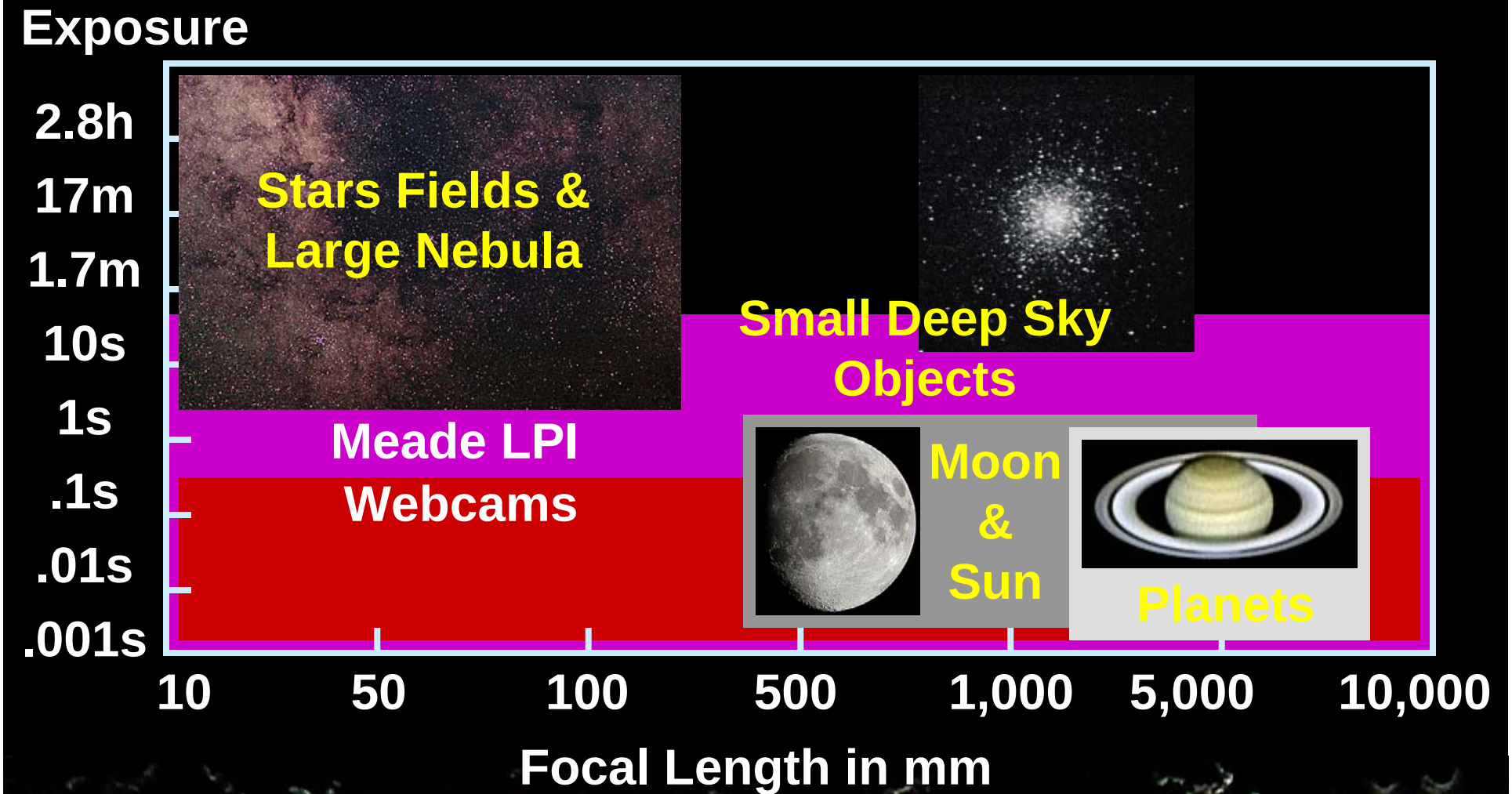
# Exposure vs. Focal Length

Focal Ratio is third parameter



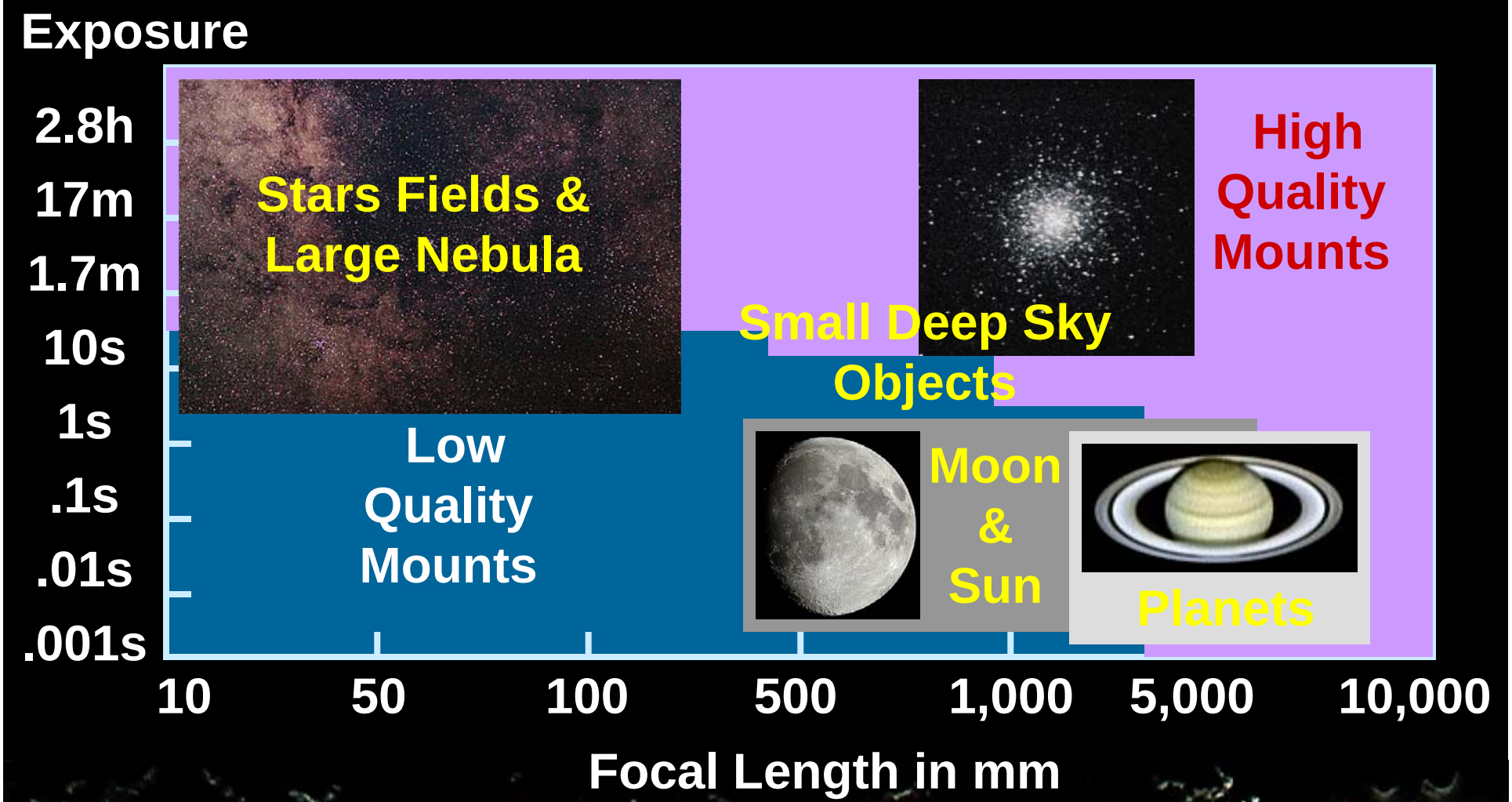
# Exposure vs. Focal Length

## Short Exposure Cameras



# Exposure vs. Focal Length

## Mounts



# ToUcam Imaging

- Advantages
- Disadvantages
- Hardware
- Software

# ToUcam PRO Advantages

## Philips PCVC740K ToUcam PRO

- Good for bright objects
  - Moon, Sun & Planets
- Acquire many images very quickly
- Low cost if you have a laptop with USB

# ToUcam PRO Advantages

## Philips PCVC740K ToUcam PRO

- No external power is needed
- Smallest pixel size 5.6μm
- Small & light weight

# ToUcam Imaging

- Advantages
- Disadvantages
- Hardware
- Software

# ToUcam PRO Disadvantages

Philips PCVC740K ToUcam PRO

- Not good for deep sky objects
- Limited to short exposures
  - Typical max 1/25 sec.
  - Special max 1/5 sec. mode
- 640x480 size

# ToUcam PRO Disadvantages

## Philips PCVC740K ToUcam PRO

- Typically images are noisy
- AVI compression
- Dropped frames

# ToUcam PRO Disadvantages

Philips PCVC740K ToUcam PRO

- Light leaks through white plastic case when solar imaging
- Hard disk is filled quickly
  - 140 sec. = 620 MB AVI file

# ToUcam Imaging

- Advantages
- Disadvantages
- Hardware
- Software

# Orion Atlas 10 Reflector on G-11

254 mm aperture, f/4.7 focal ratio, 1200 mm focal length

# Cooling the Mirror Before Imaging

# Focusing

## Diffraction Focusing

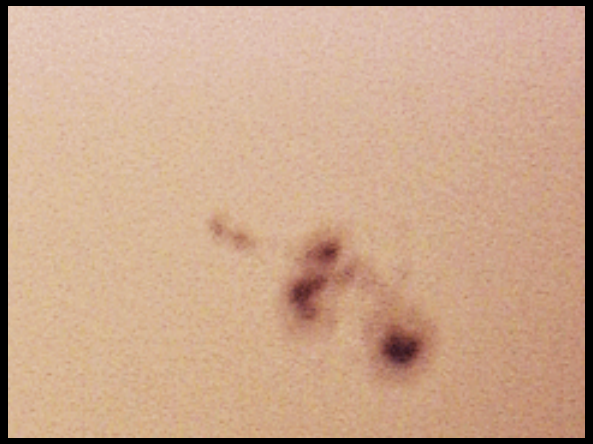

# Beta Lyra Double Star 46"

## Diffraction Focusing

# Finding the Planet

## Cross Hairs Eyepiece

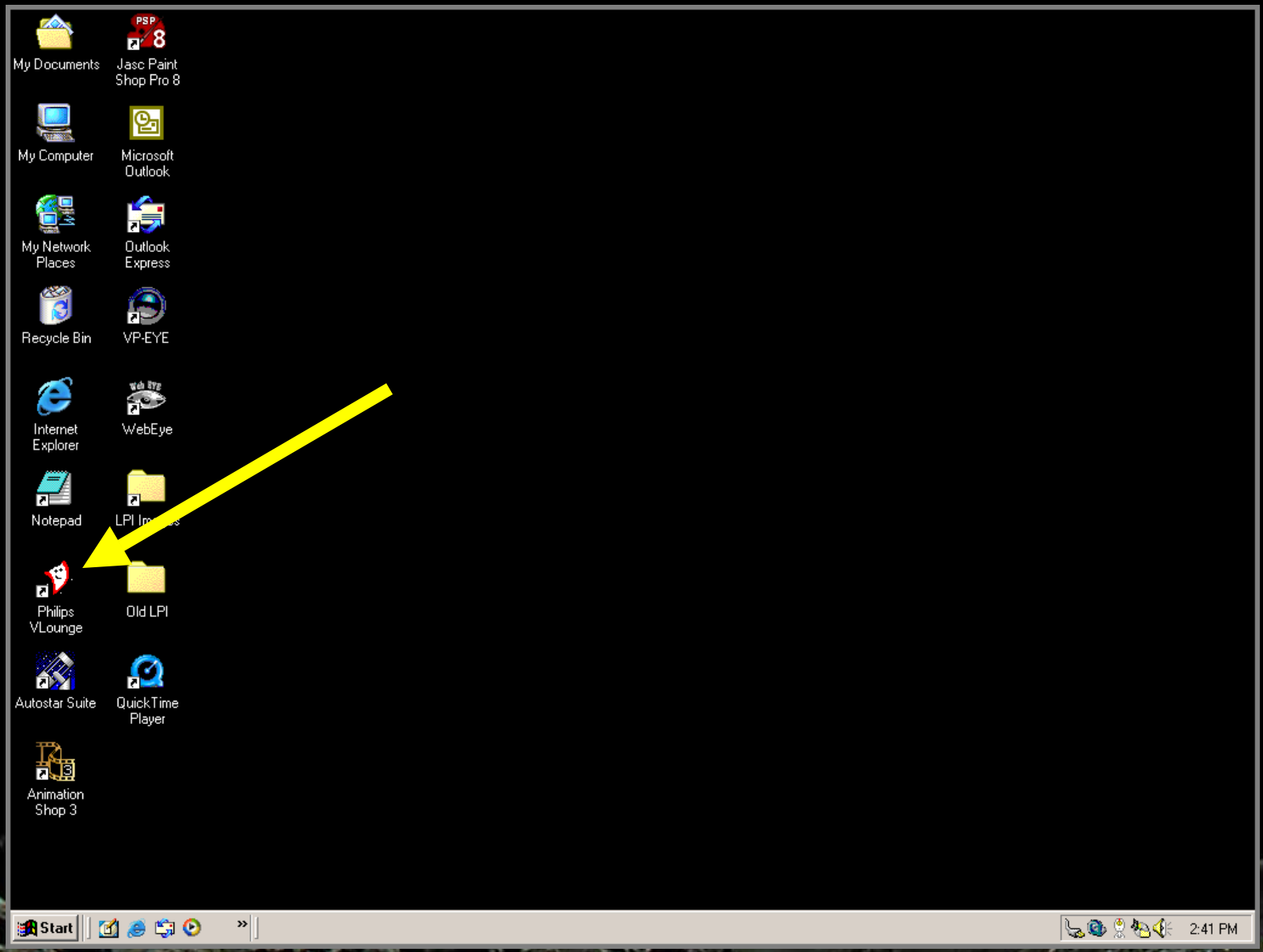
# Solar Imaging



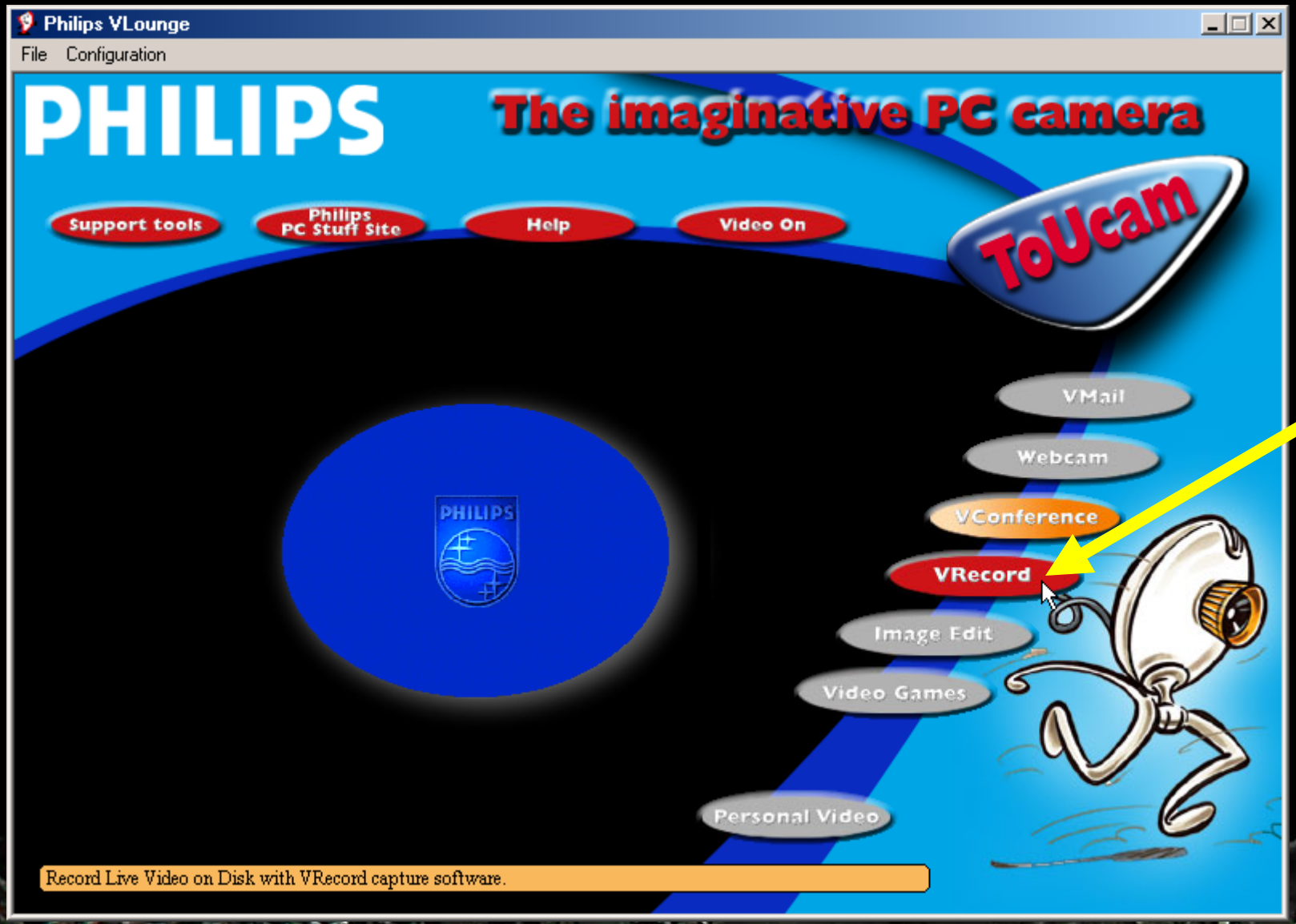
# ToUcam Imaging

- Advantages
- Disadvantages
- Hardware
- Software

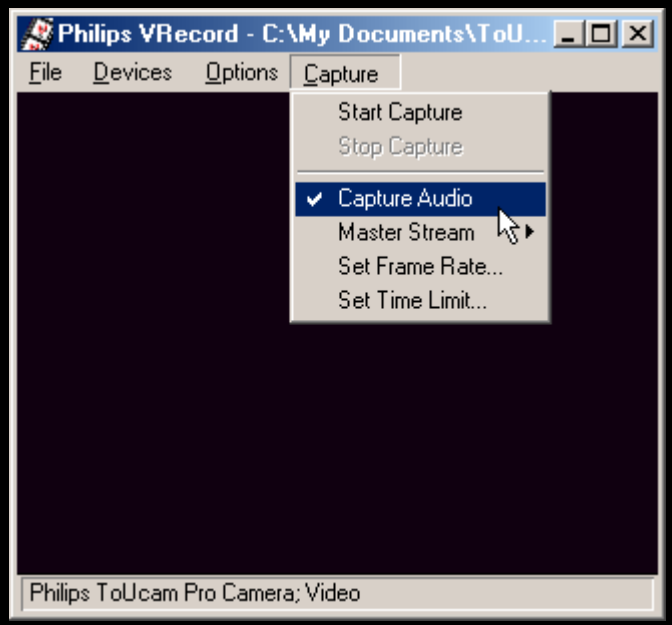
# ToUcam VLounge

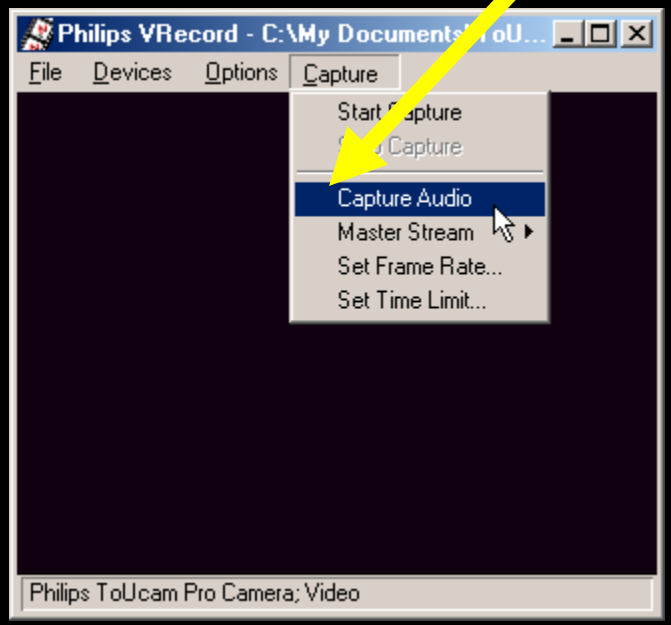


# ToUcam VLounge

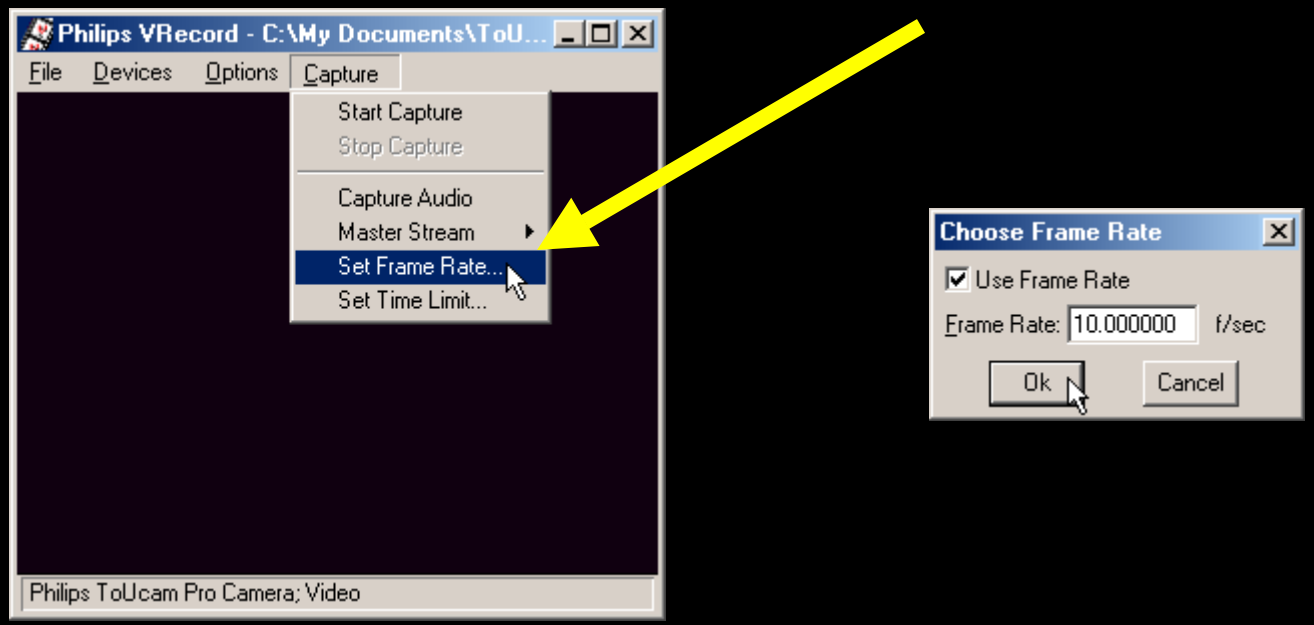


# ToUcam VRecord



# ToUcam VRecord



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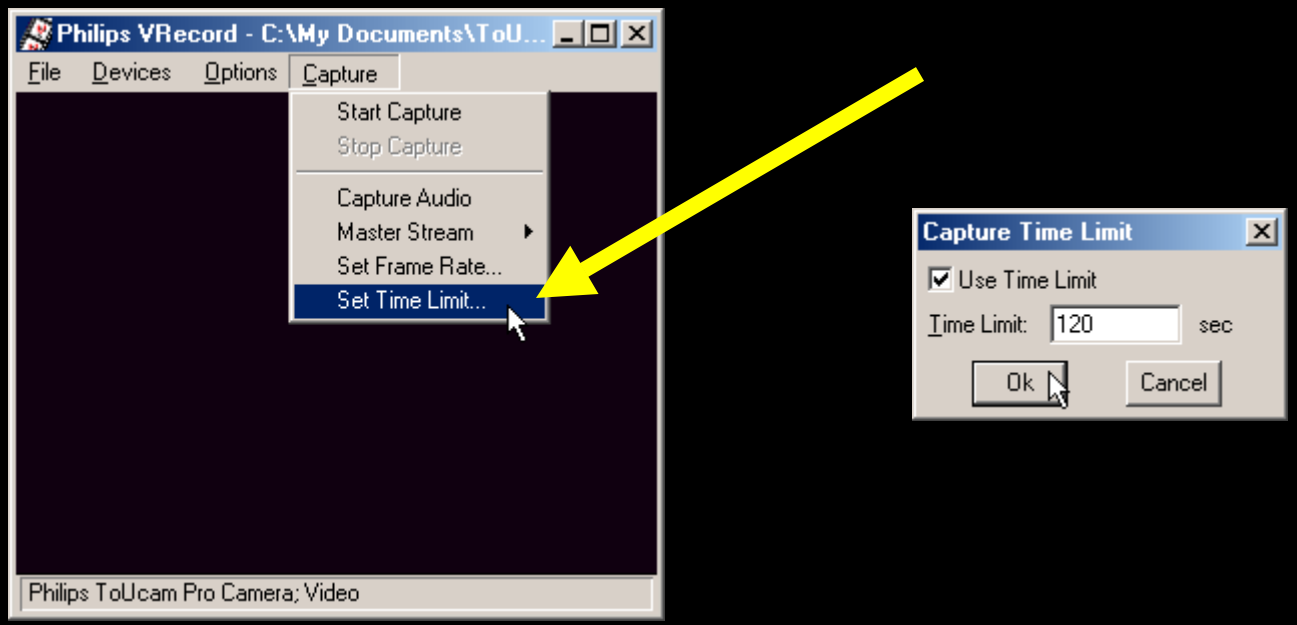
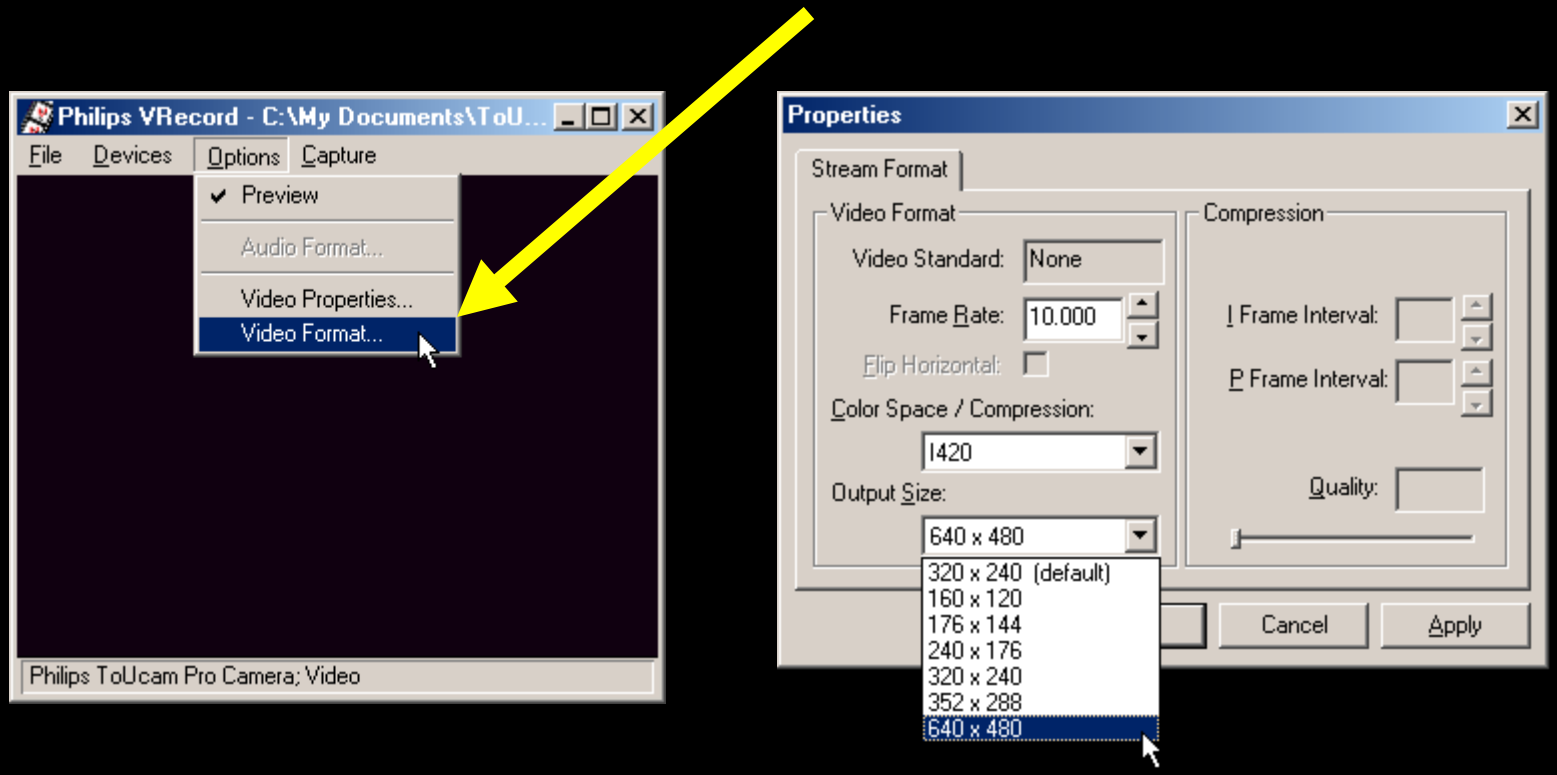


# ToUcam VRecord



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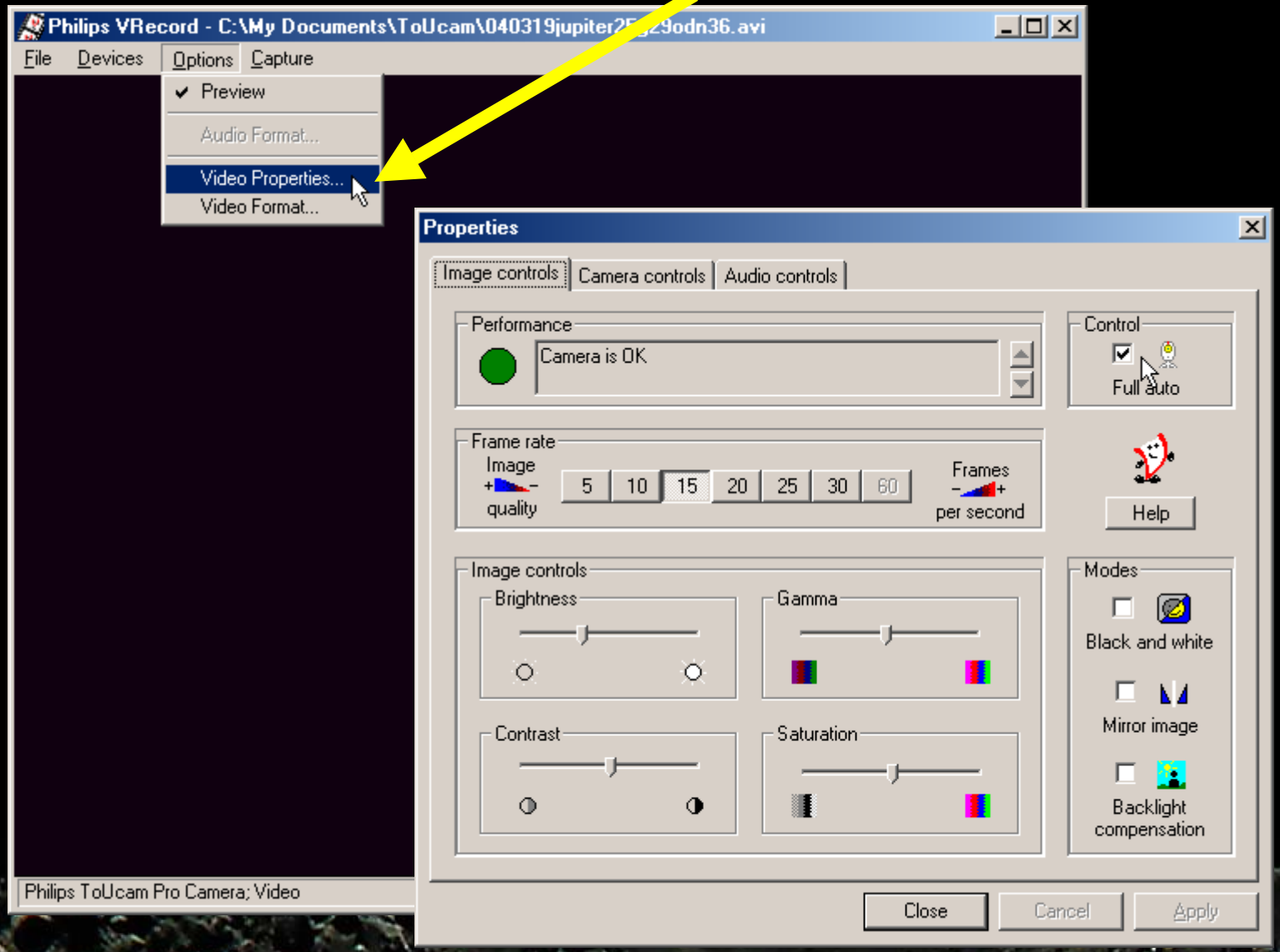

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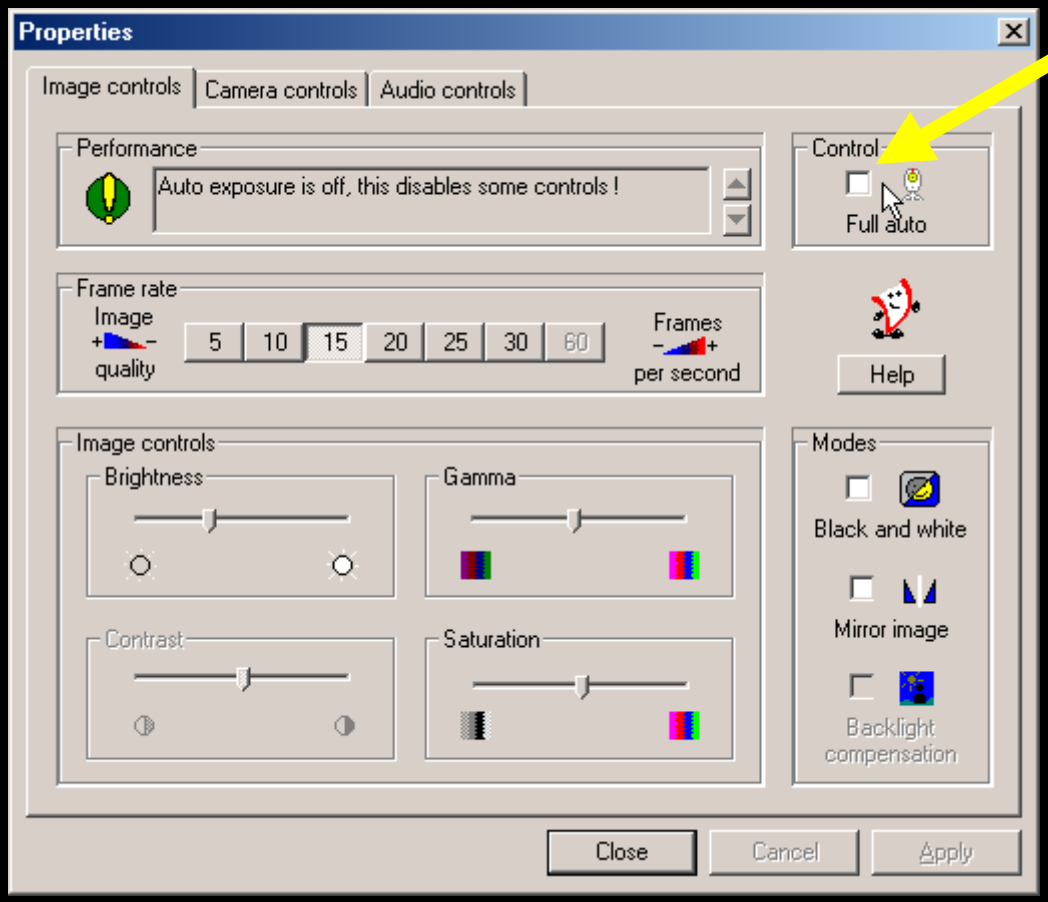
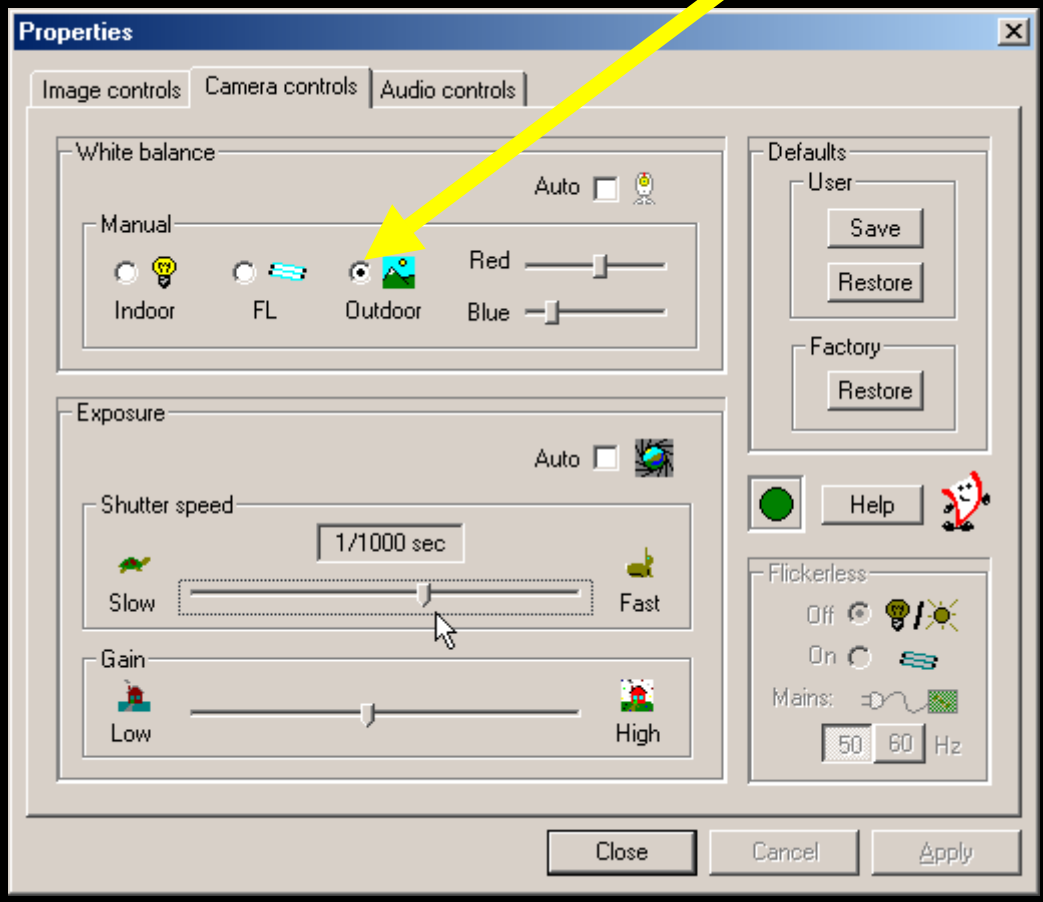


# ToUcam VRecord



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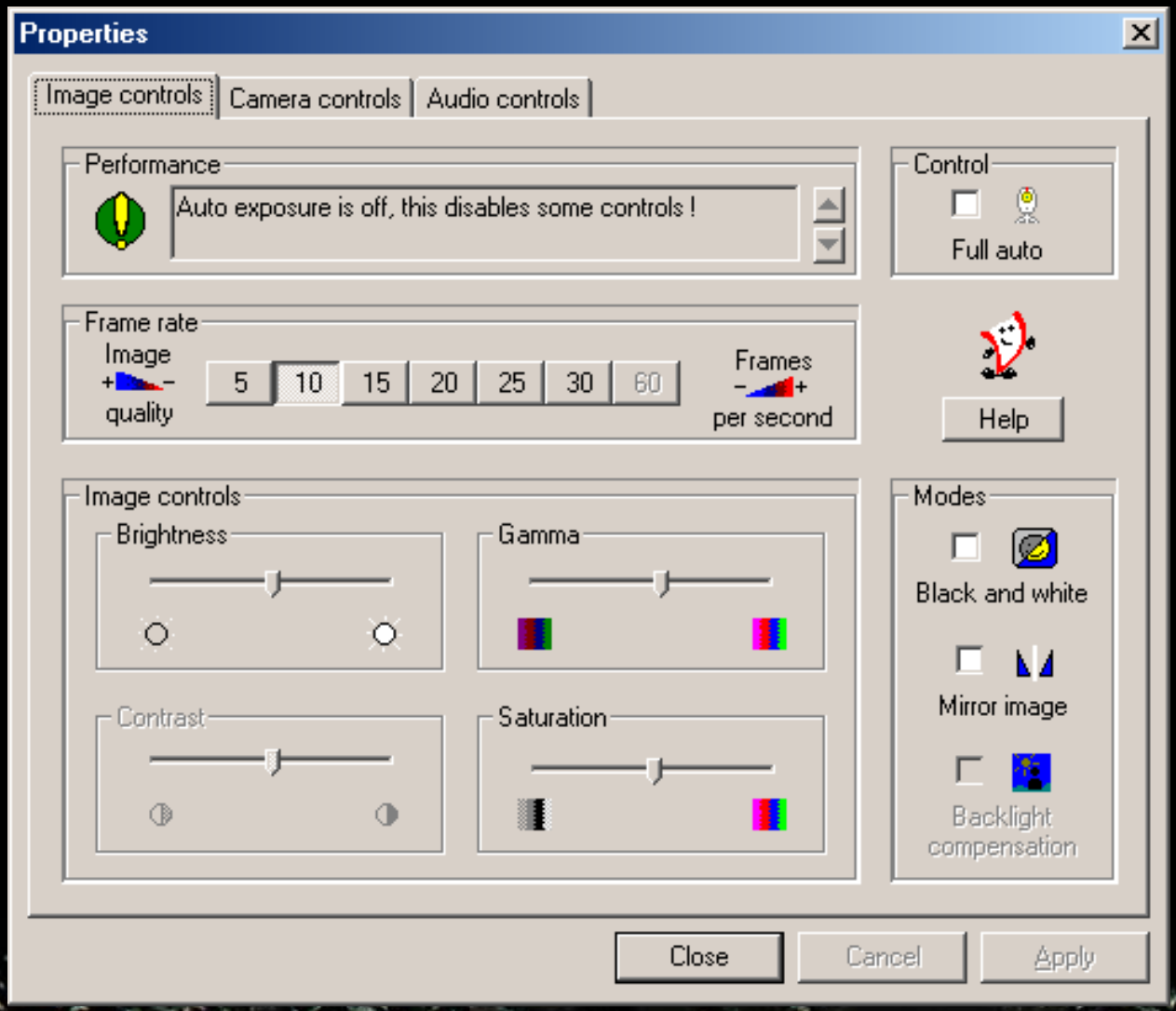
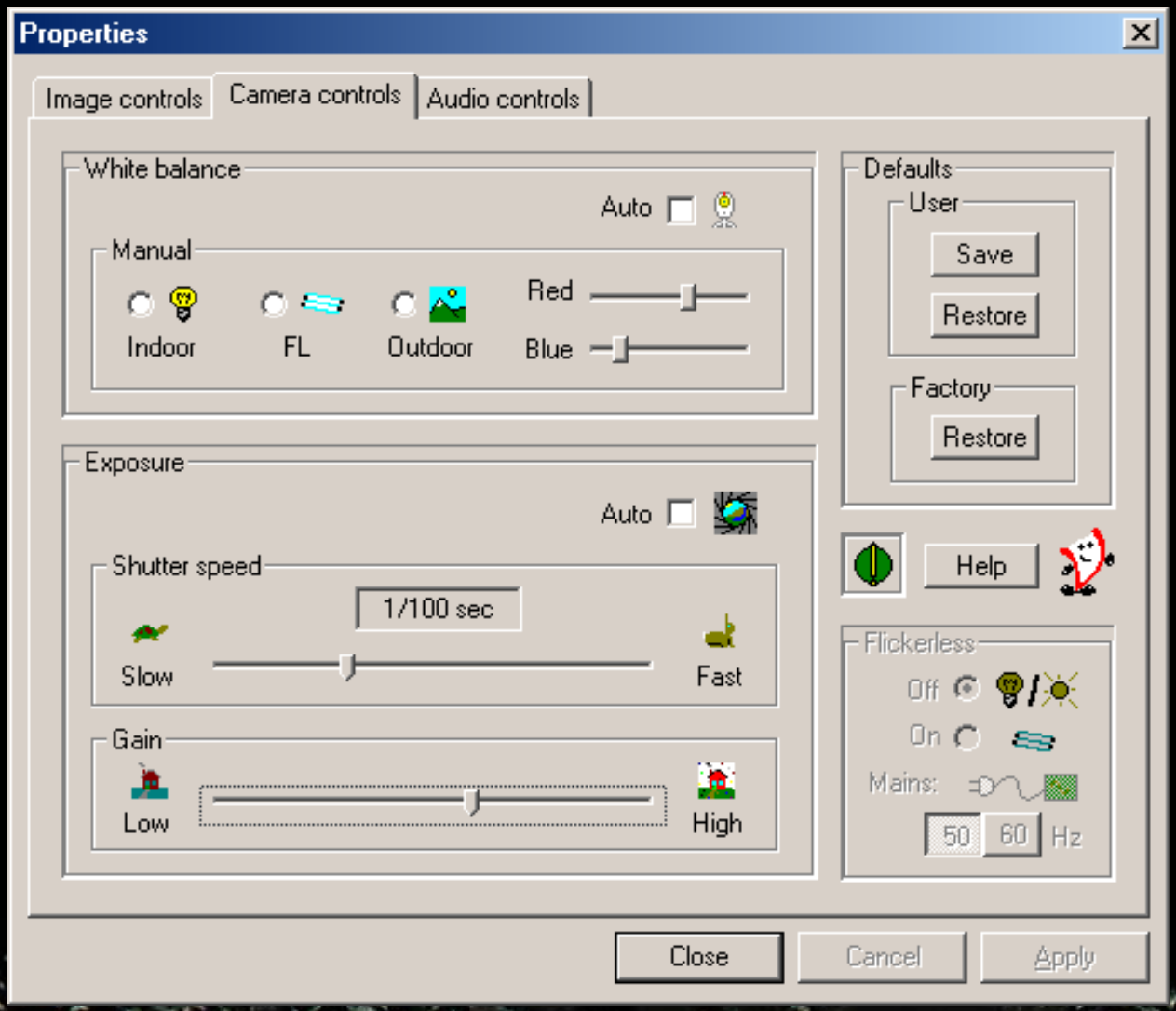


# ToUcam VRecord



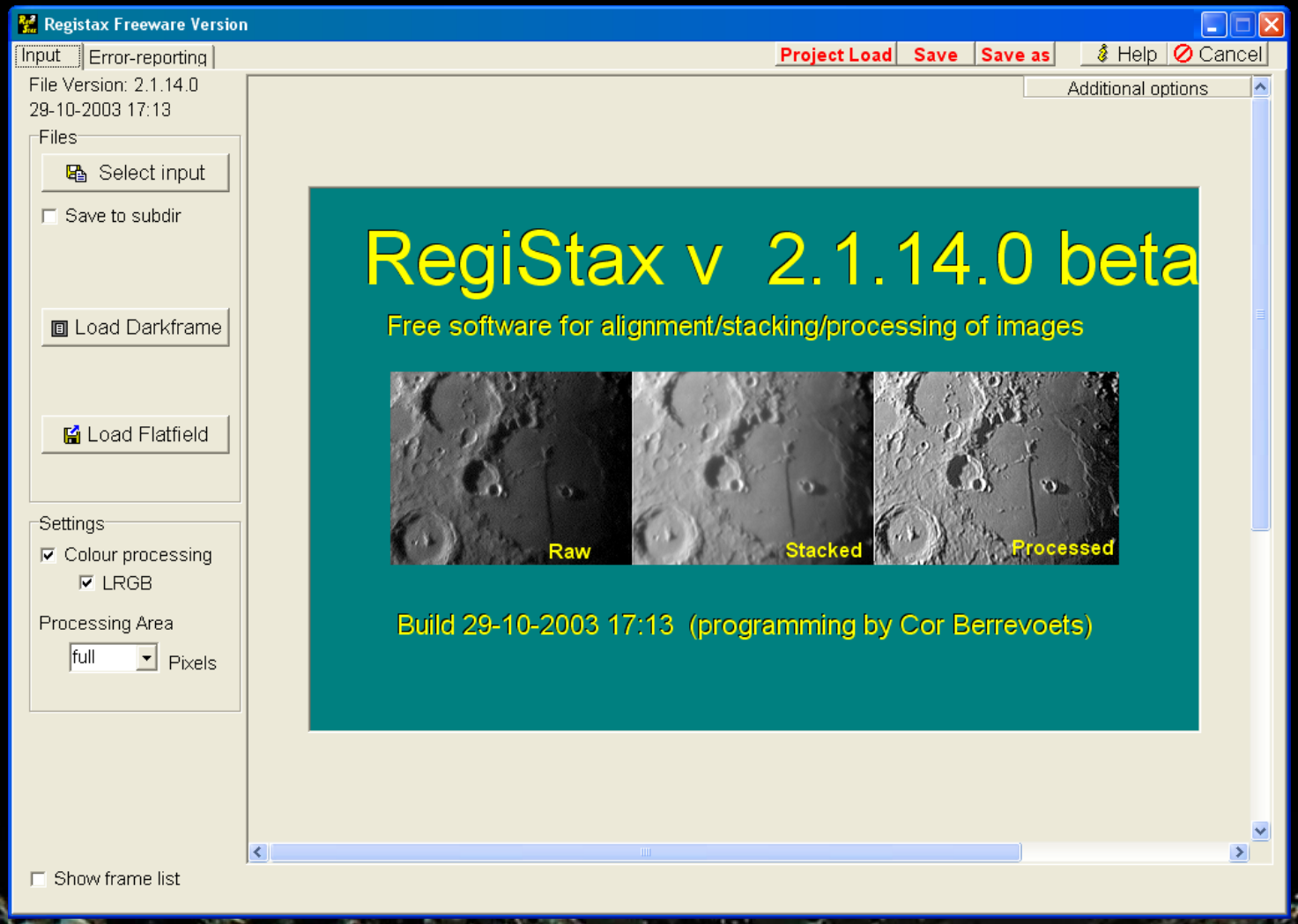
# Saturn 1/19/2004

Orion Atlas 10 Reflector on G-11

Tele Vue 5x Powermate (effective >f/23.5, >6000 mm)

# Cor Berrevoets RegiStax

http://aberrator.astronomy.net/registax/



# Saturn 1/19/2004

RegiStax: 1024 Images Stacked a 2x

# Saturn 1/19/2004

RegiStax: 1024 Images Stacked a 2x
Wavelet, Gamma, Brightness Processed

# Saturn 1/19/2004

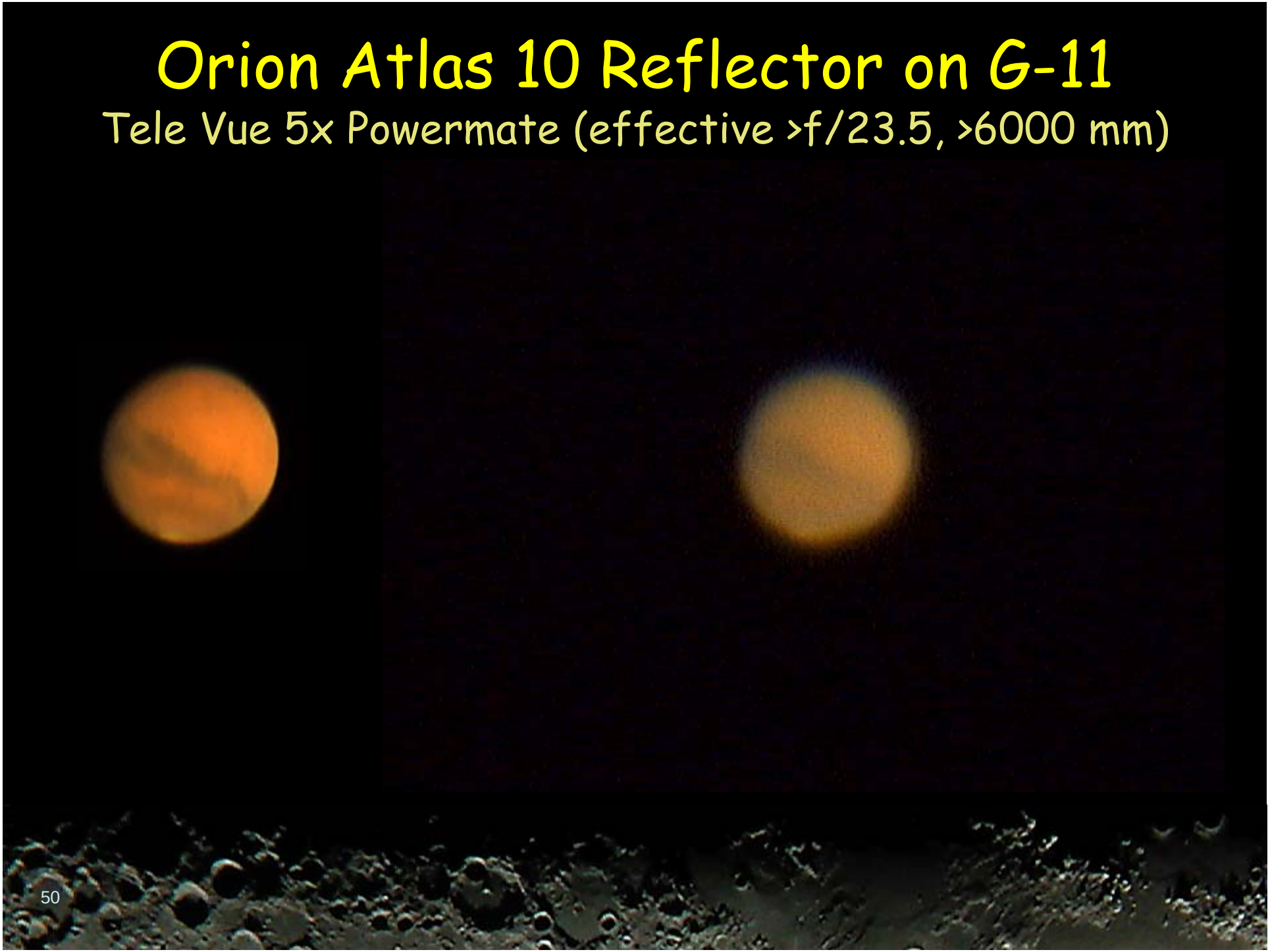
RegiStax: 1024 Images Stacked a 2x
Wavelet, Gamma, Brightness Processed
Photoshop: Unmask Sharpen, Color Balance, Resize to 1x

# Saturn 1/19/2004

RegiStax: 1024 Images Stacked a 2x
Wavelet, Gamma, Brightness Processed
Photoshop: Unmask Sharpen, Color Balance, Resize to 1x
Resize to 0.5x, Unmask Sharpen,

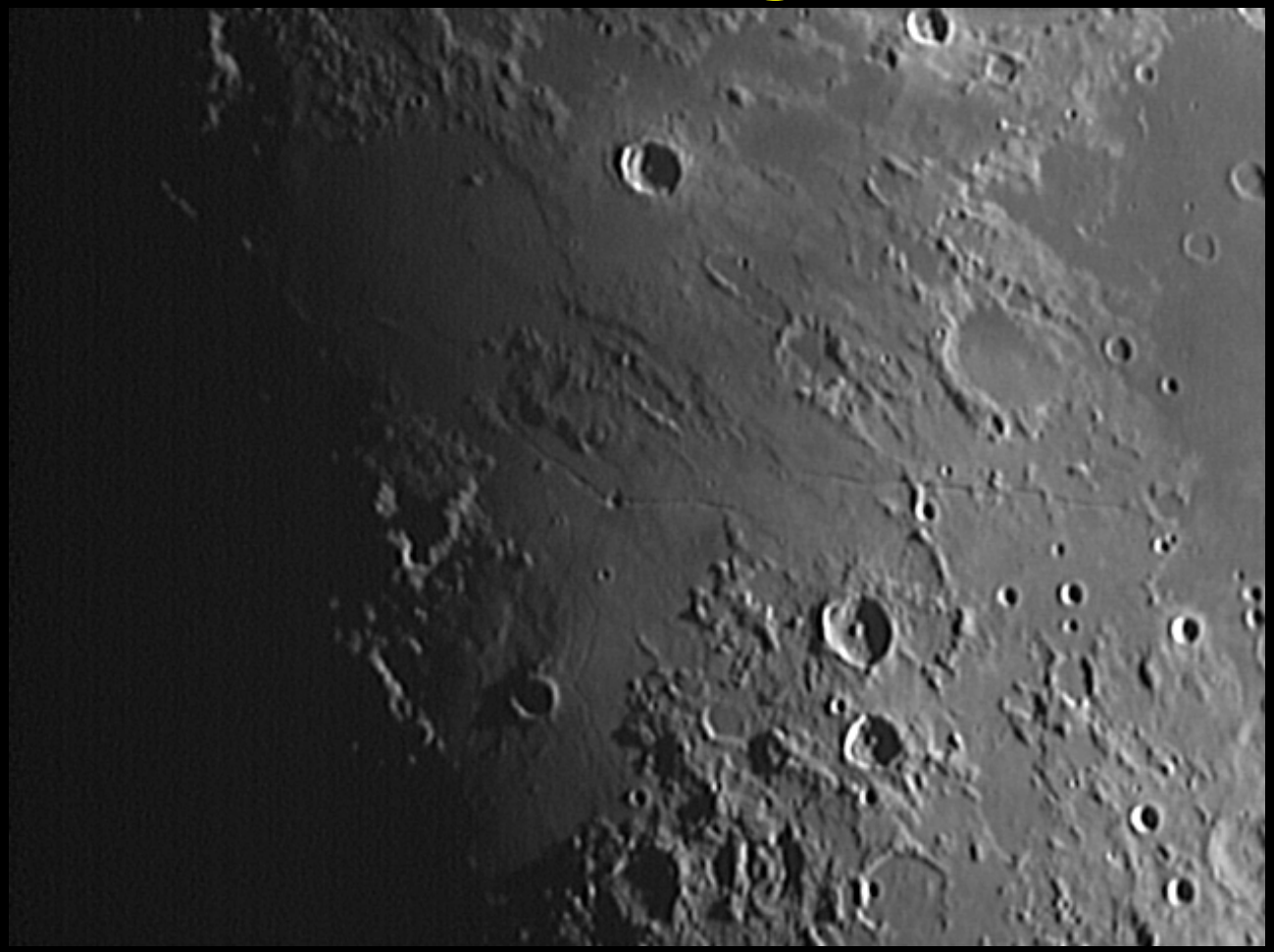
# Orion Atlas 10 Reflector on G-11

Tele Vue 5x Powermate (effective >f/23.5, >6000 mm)



# Moon with Good Seeing

# Moon ToUcam Image Processed



# Sun ToUcam

## Using Orion 80mm Refractor 400mm Focal Length

**ToUcam 301 images stacked**

# Meade Lunar Planetary Imager (LPI)

- Advantages
- Disadvantages
- Software

# Meade LPI Advantages

- Good for bright objects
  - Moon, Sun & Planets
- Real-time image processing
  - Electronic eyepiece
  - Selecting, stacking & sharpening

# Meade LPI Advantages

- Acquire many images quickly
- Low cost if you have a laptop with USB
- No external power is needed

# Meade LPI Advantages

- No compression
- Small & light weight
- Color balance is better than the 740 on Jupiter

# Meade LPI Advantages

- .001 to 16 seconds exposure
  - Some bright deep sky objects are possible
- Save images in different formats

# Meade Lunar Planetary Imager (LPI)

- Advantages
- Disadvantages
- Software

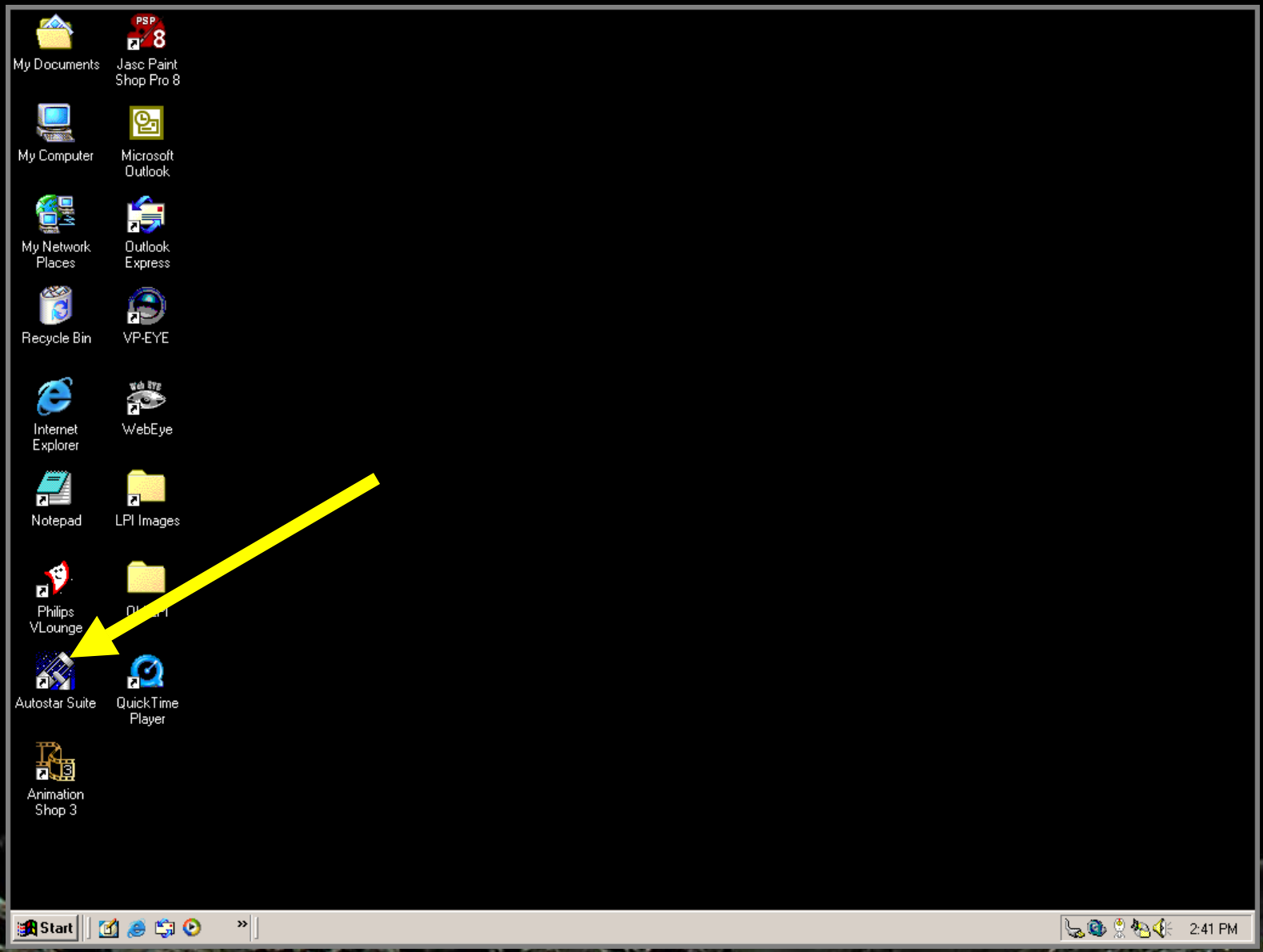
# Meade LPI Disadvantages

- Less sensitive to light than 740
- No solar image mode
- No color balance
- Software crashes
- 640x480 size

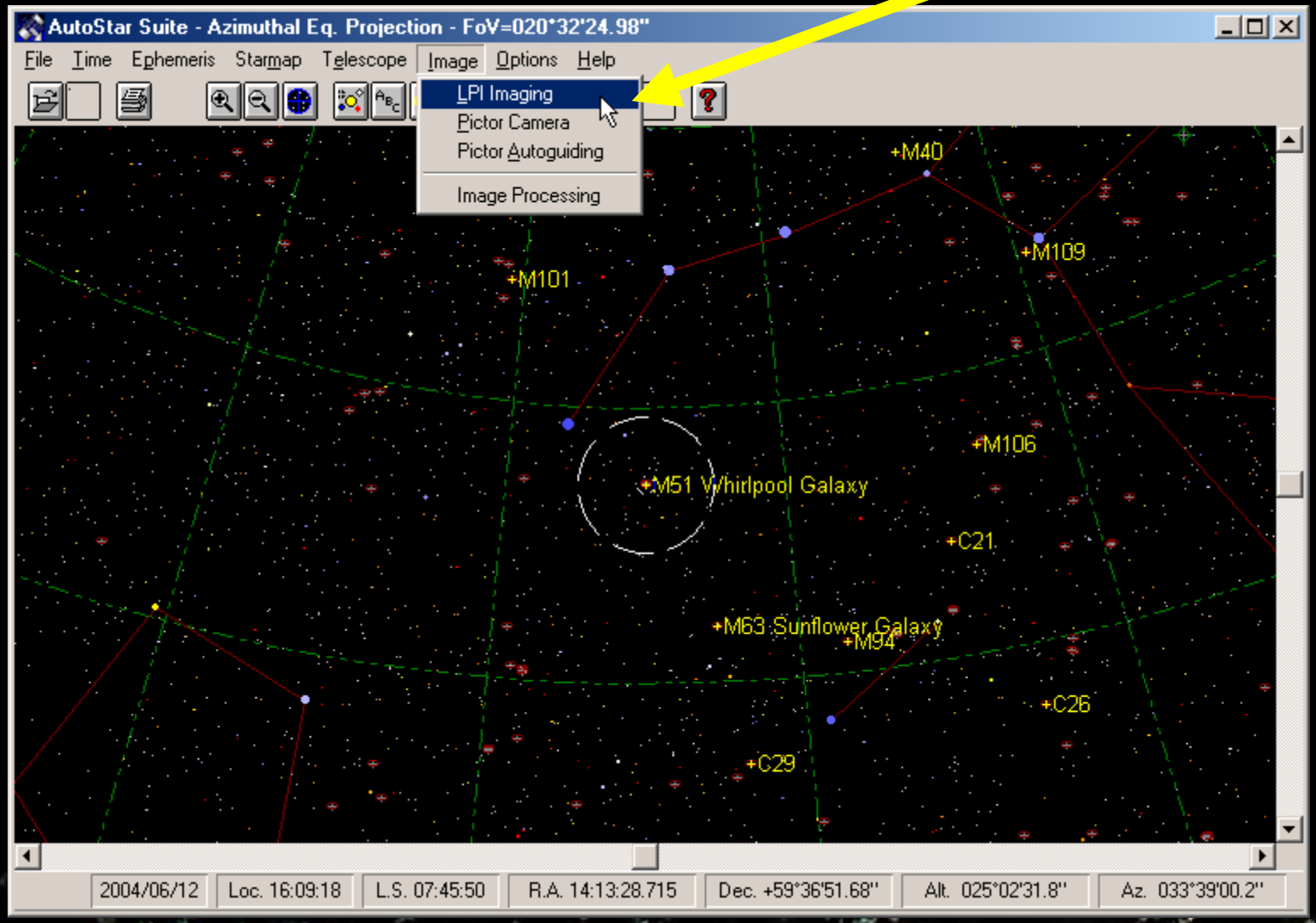
# Meade Lunar Planetary Imager (LPI)

- Advantages
- Disadvantages
- Software

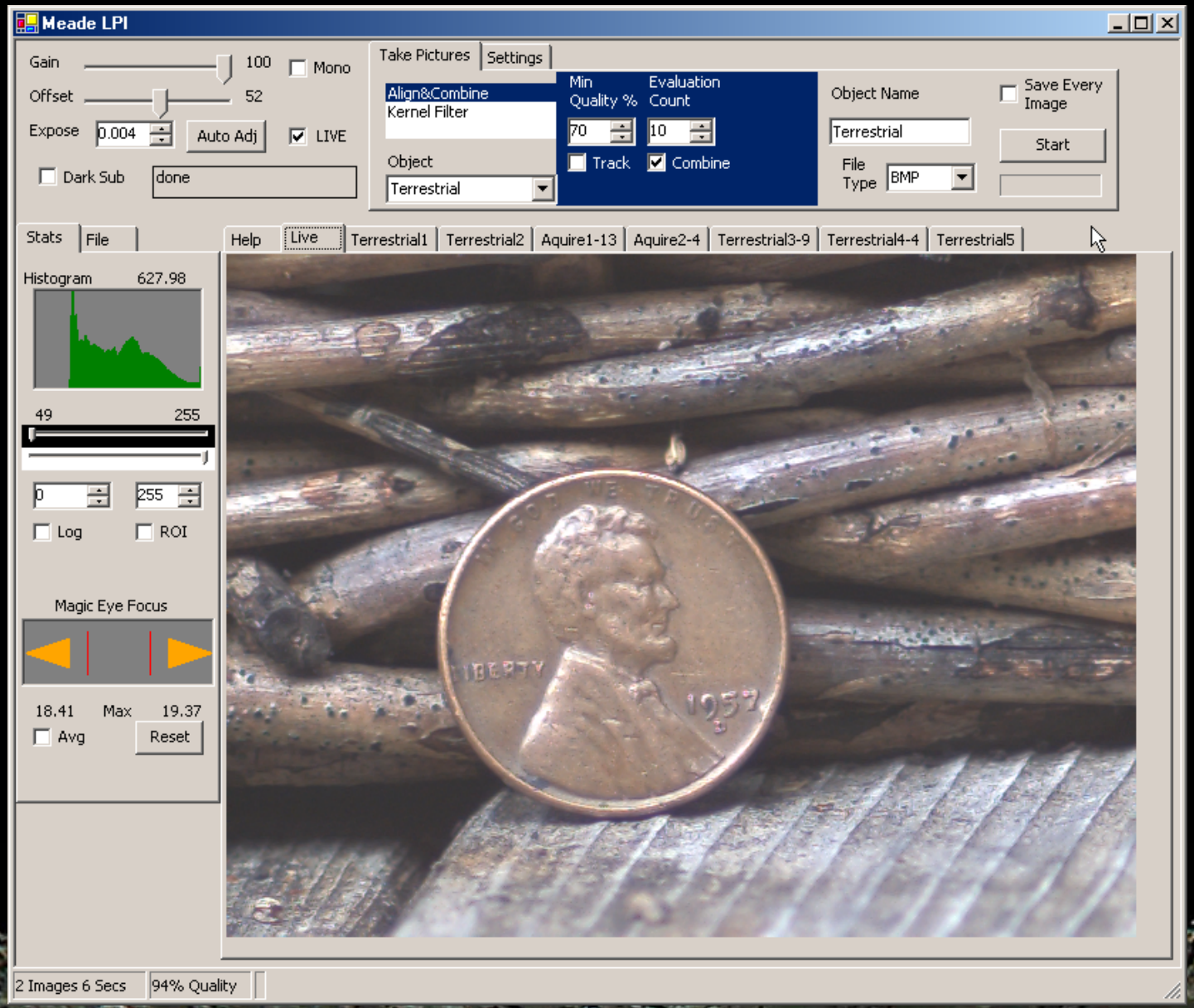
# Meade LPI Autostar Suite



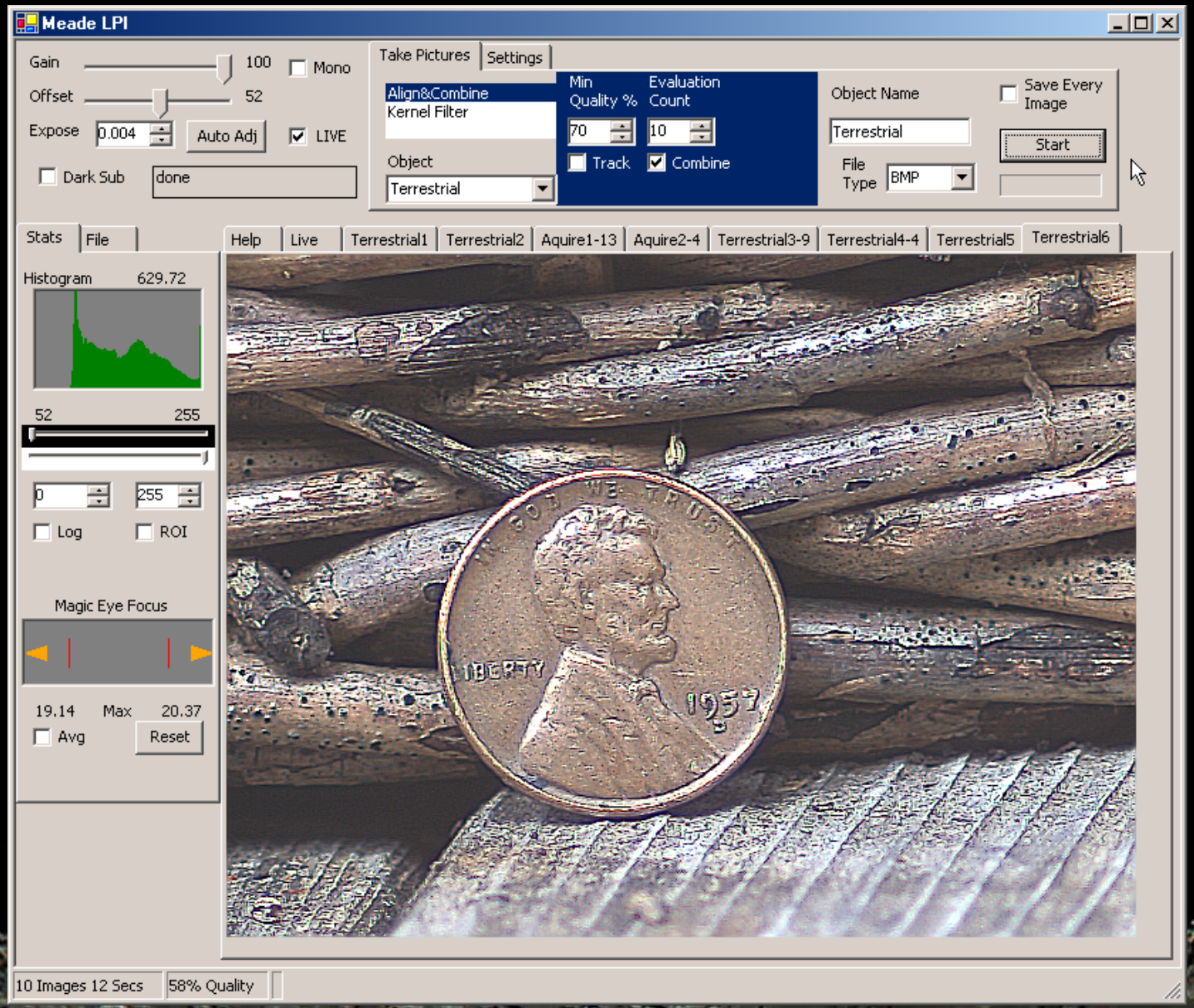
# Meade LPI Imaging



# Meade LPI Imaging



# LPI Real-time Image Processing



# One Image versus Image Processing

LPI

One Image

One Image with Image Processing

# One Image versus Image Processing

LPI

One Image

22 Images stacked LPI Processed at the Telescope

# One Image versus Image Processing

LPI

22 Images stacked
LPI Processed

22 Images stacked LPI
Processed, RegiStax Wavelet

# One Image versus Image Processing

LPI

22 Images stacked
LPI Processed

22 Images stacked LPI
Processed, RegiStax
Wavelet, Photoshop

# One Image versus Image Processing

LPI

One Image with Image Processing

22 Images stacked LPI Processed, RegiStax Wavelet, Photoshop

# Sun 7/25/2004

Photoshop Version CS, unsharp mask and crop

# LPI Images 4/26/2004

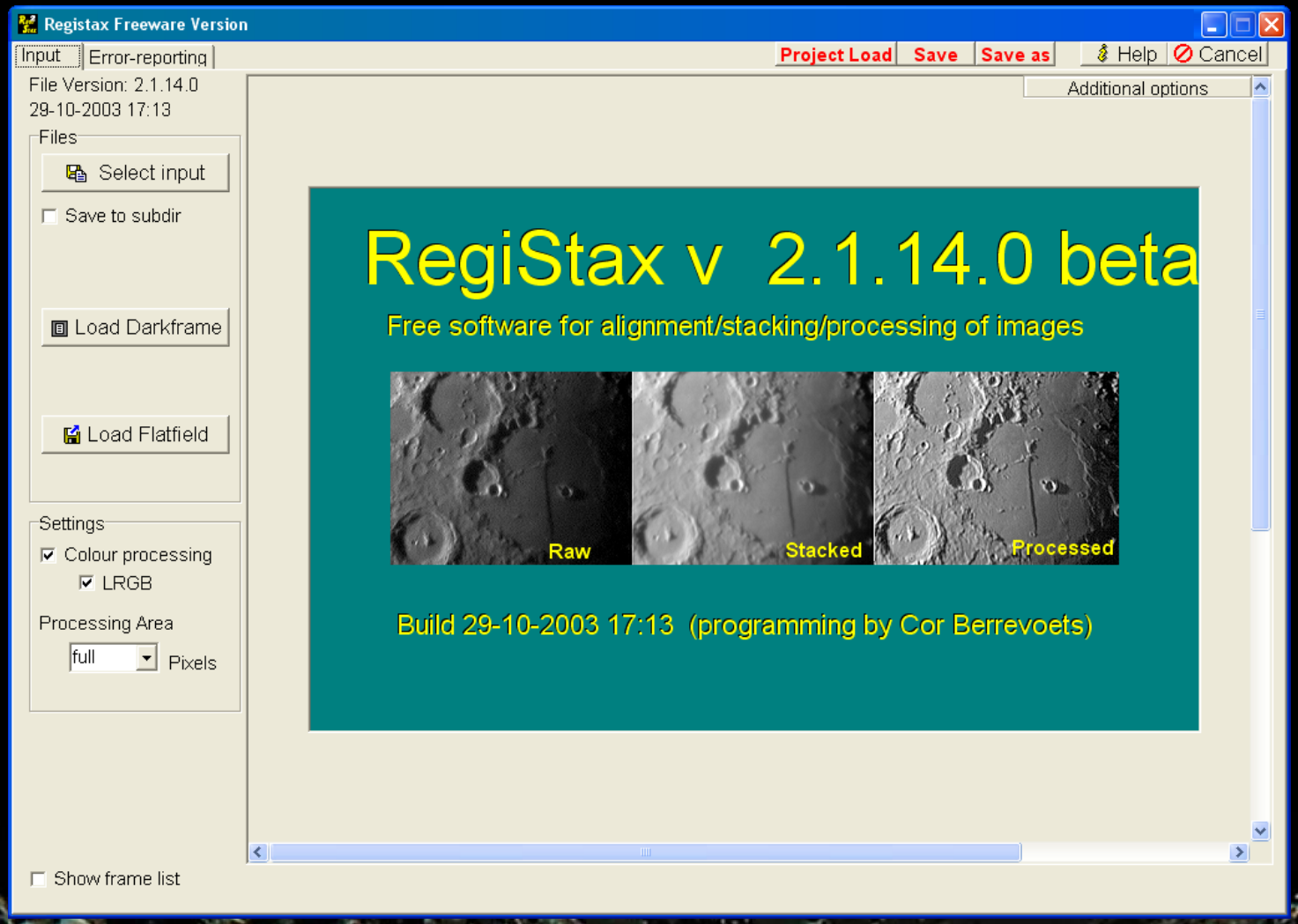
## Argonaut™ 150mm Maksutov-Cassegrain & 2X Barlow

# Moon 5/1/2004

Orion Argonaut™ 150mm Maksutov-Cassegrain on EQ-3
Tele Vue 2x Barlow (effective >f/24, >3600 mm)

# Cor Berrevoets RegiStax

http://aberrator.astronomy.net/registax/

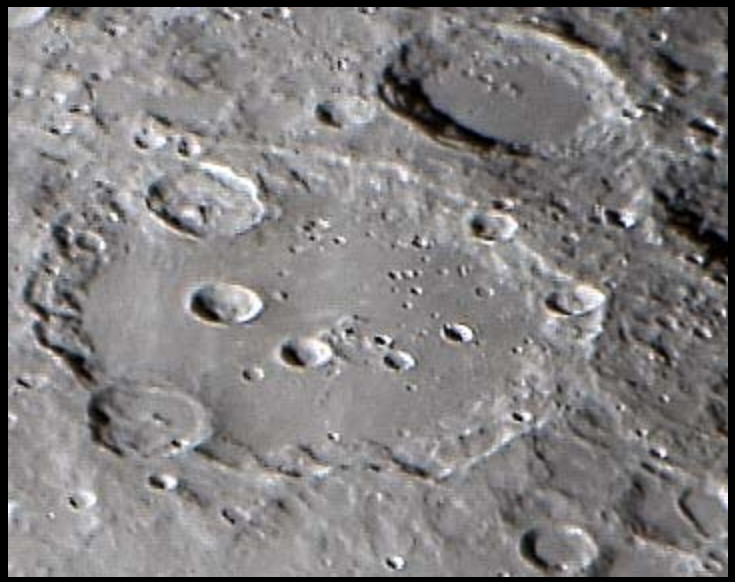


# Moon 5/1/2004

Registax Version 2.1.14.0 beta, wavelett processed

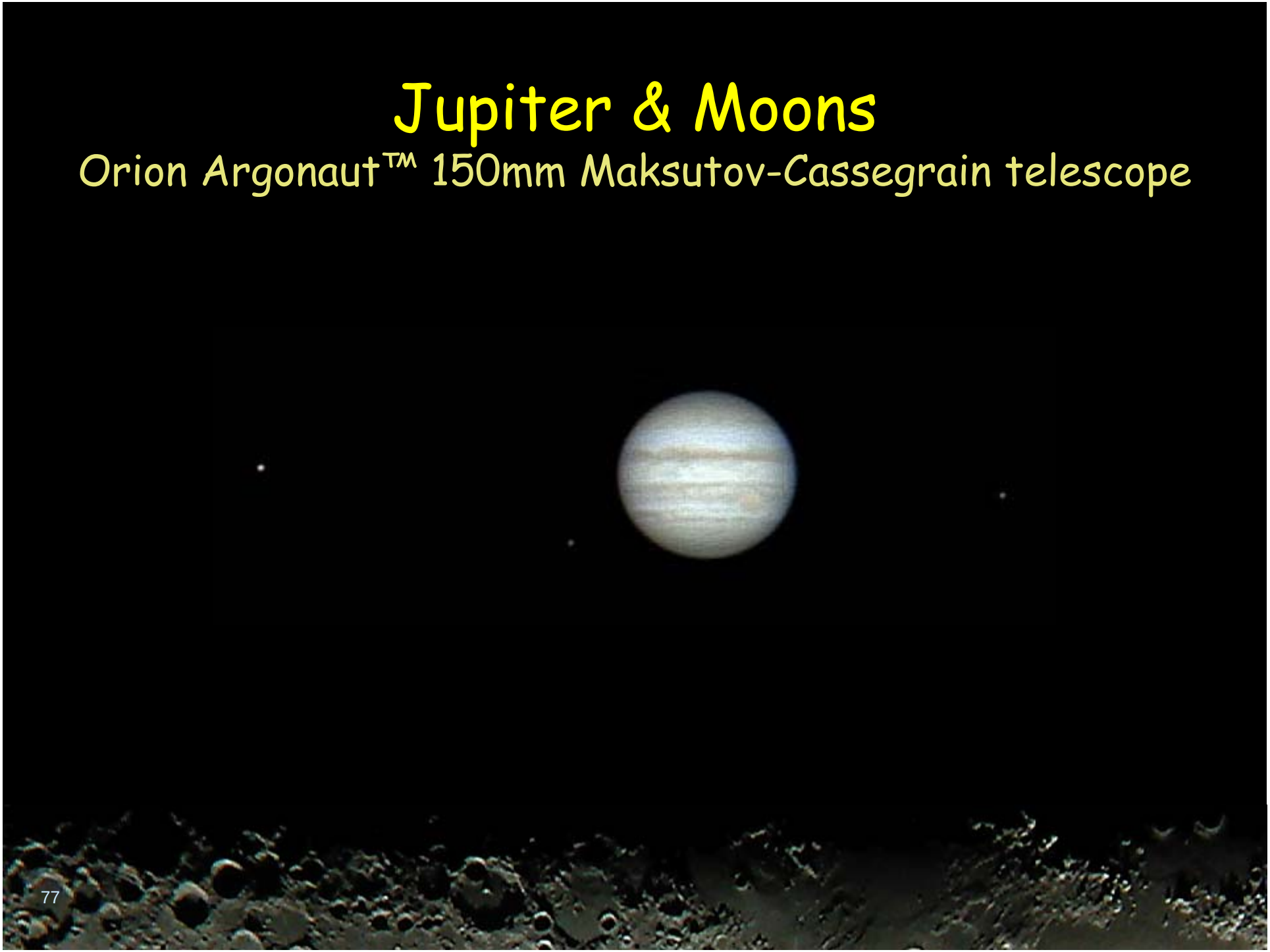
# Moon Clavius Craterlets 5/1/2004

Photoshop Version CS, unsharp mask, levels, and crop



# Jupiter & Moons

Orion Argonaut™ 150mm Maksutov-Cassegrain telescope



# Webcam & LPI Imaging

| | Cost | Availability | Time to use |
|---|---|---|---|
| 740 | $93 + $75 IRF $20 Adp. | Not available, Replaced by 840 | Less than 5 minutes |
| LPI | $150 | Sean's Astronomy Shop | Ready to use |

# Webcam & LPI Imaging

| | Advantages | Disadvantages |
|---|---|---|
| 740 | Good light sensitivity, Smallest pixels, ready to use adapters | Large AVI files, long image processing time |
| LPI | Real-time image processing, good color balance, electronic eyepiece | Less light sensitive, software crashes |

# Astroimaging Information

## www.stargazing.net/david/