

Getting Started with Video Astronomy

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Outline

- Why Video Astronomy?
- What Is the Minimum Equipment Needed?
- Optional Equipment You May Want
- What Can You Expect to See?
- Dedicated Astro-Video Camera Choices
- Image Capture Setup & Examples of Imaging
- What additional resources are available?
- Live Demo w/ C9.25 SCT @ $\sim f/4.5$ + MC Xtreme on CG-5 Mount

Why Video Astronomy?

- See Much More
 - 2-3X “effective” aperture increase at a fraction of the cost
 - Color ... human eye is not sensitive to color in low light conditions
 - Compensate for aging vision
- Comfort
 - View from a comfortable chair instead of crouched beneath the scope or perched atop a ladder
 - Get out of the cold and damp air or away from the mosquitoes and sit inside a warm tent or inside your house
- Outreach
 - Show more than just the moon/planets and star clusters even in light polluted conditions
 - Eliminate long lines and ladders at the EP
 - Easier to point out object features when everyone can see them on a monitor
 - Better accommodate the physically handicapped
- Imaging Made Simple
 - Less costly way to get started
 - Simple equipment and methods
 - Capture a record of the objects you see (Messier Challenge, Herschel 400, etc.)

What Is the Minimum Equipment Needed?

- Any Telescope or Camera Lens
- Mount (Tracking or non-tracking)
- Video camera w/C-mount
- Video Monitor (CRT/LCD/DVD Player) w/power
- 12V battery
- Camera Power Cable
- BNC/RCA or S-Video Cable to Monitor



Optional Equipment

- Optional Additional Equipment
 - Focal reducer
 - Filters (LP, Ha, OIII, etc.)
 - Wired or wireless controller
 - Cooling Fans
 - DVD recorder
 - Computer & Software
 - Video Capture device
 - Guide camera & OAG or guide scope



... for wider FOV, shorter exposures



... to enhance contrast, minimize light pollution

... for easier control of the camera

... to reduce hot/warm pixels

... to capture video

... for camera control

... for image capture, manipulation and stacking

... for long exposures or stacking



What Can You Expect to See?

- **Deep Sky Objects like you never have seen with your best EP**
- The cameras I will discuss are optimized for Deep Sky, not planetary viewing. However, most will do a much better job on planetary images than planetary cameras available a few years back.
- CCDs designed for low-light surveillance cameras
- Large pixels ~8.4 x 9.8 micron pixels
- Frame accumulation allows exposures of 2 sec to infinity
- Automatic Gain Control to increase camera sensitivity
- Gamma control to stretch grey scale
- Brightness/Contrast adjustments
- Can use full range of filters, broad-band, line, color (with B/W cameras)

Unprocessed <30sec Exposures @ CalStar



NGC253
14sec C14 f/2 AGC4
9-15-2012
Lake San Antonio, CA



NGC6946
28sec C14 f/2 AGC4
9-15-2012
Lake San Antonio, CA

Unprocessed <30sec Exposures @ CalStar



NGC7635 Bubble Nebula
28sec C14 f/2 AGC4
9-15-2012
Lake San Antonio, CA



NGC7293 Helix Nebula
28sec C14 f/2 AGC4
9-15-2012
Lake San Antonio, CA

Unprocessed 1-2min Exposures in Livermore



M42
56sec C9.25 ~f/4.5
Astronomic CLS-CCD + IR
2/16/2012 Livermore



M13
2min C9.25 f/4.5 CLS-CCD
6-25-2011 Livermore, CA

Unprocessed 1-2min Exposures in Livermore



NGC2392 Eskimo Nebula
2min C9.25 f/10
Astronomic CLS-CCD
1/16/2012 Livermore



M82
2min C9.25 f/6.3 AGC2 CLS-CCD
2-2-2011 Livermore, CA

Unprocessed 1-2min Exposures @ GSSP 7-2-2011



M16 1min C9.25 ~ f/4.5 IR Filter



M20 2min AGC 3 C9.25 ~ f/4.5 IR Filter



NGC4565
2min C9.25 ~ f/4.5 IR Filter



M27 2min
AGC 3 C9.25 ~ f/6.3 UV-IR Filter

Typical Dedicated Astro-Video Camera Choices



- Available from Mallincam, Astrovid, Orion, Astro-Video Systems, GStar

- Common Attributes

- 1/2" format Sony ExView HAD (Hole Accumulation Diode) CCD
 - ~8.4 x 9.8µm pixel size, 768 x 494 active pixels
 - Color or B/W
- Electronic shutter
- Composite (BNC) analogue video connector
- Exposure range ~1/100,000 to infinity (varies by camera)
- Automatic Gain Control
- Gamma corrections 1 / 0.45 / 0.35 (varies by camera)
- Control: Rear Panel Button, Optional Wired/Wireless Keypad
- Frame rate: 30frames/sec



- High End Cameras (Mallincam, Astrovid, Astro-Video Systems)

- S-Video Output
- Infinite exposures
- Peltier Thermoelectric cooler
- Computer Control

- Entry Level Cameras (MC Micro & Astro-Video Systems DSO-1)

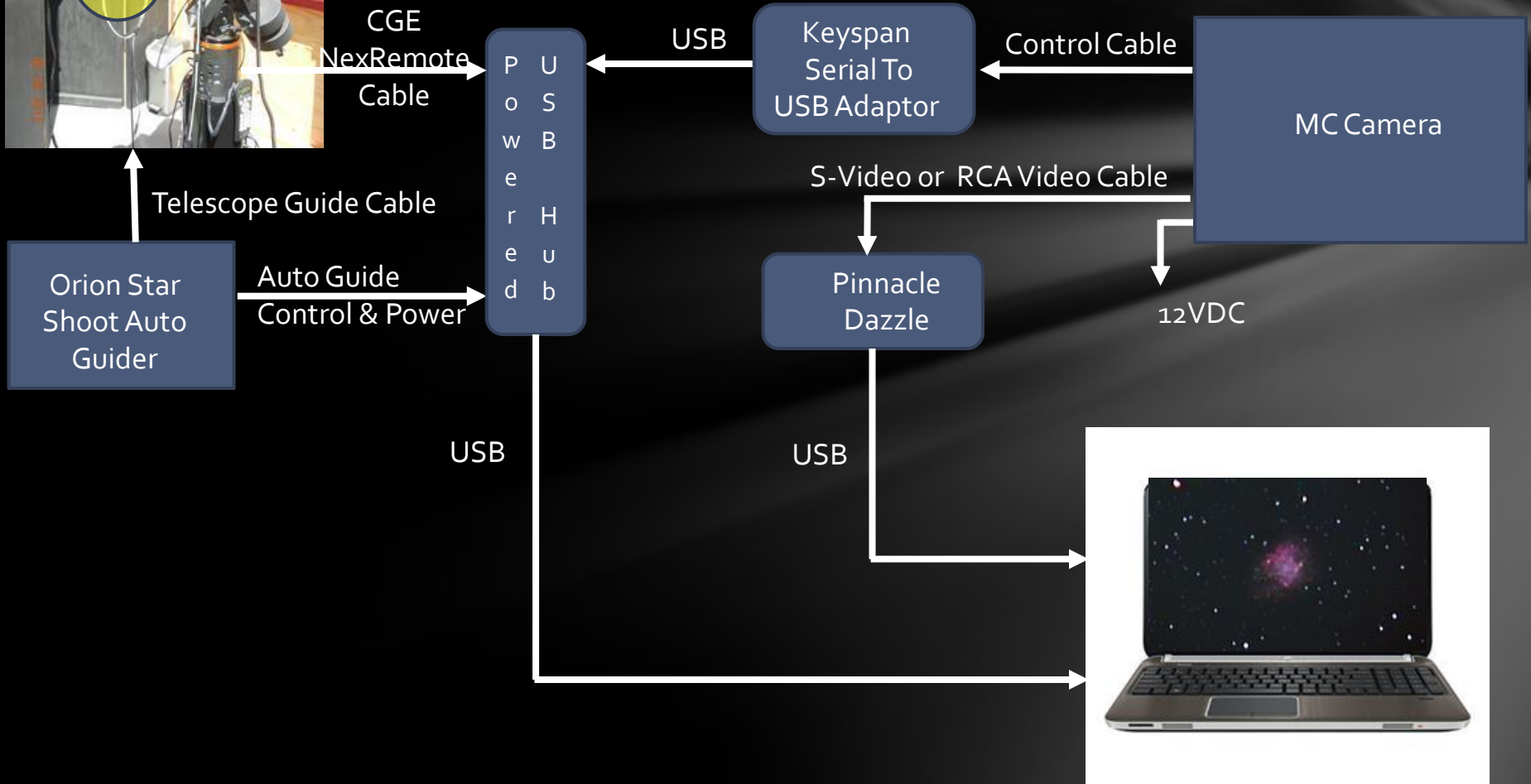
- 1/3" Sony ExView HAD II
- 1/100,000 to 17sec exposure w/85sec frame accumulation



Typical Dedicated Astro-Video Cameras

Camera	Format	Chip	Color	Pixels	Pixel Size	Exp Range	TEC	Exp Control	Menu Control	Output	Cost
MC Extreme	1/2"	ICX418AKL-A/ ICX418ALL-A	Yes/ No	768 x 494	8.4µm x 9.8µm	1/12,000 – Infinity	Yes	PC, Opt. Wireless Exp Control	PC, OSD, or Opt. Wired Key Pad	S-Video Composite	\$1499.95, (EXVHAD +\$110),
		ExView HAD ICX428AKL-A / ICX428ALL-A	Yes/ No								
StellaCam3	1/2"	ICX428ALL-A ExView HAD	No	768 x 494	8.4µm x 9.8µm	1/2,000 - Infinity	Yes	Opt Wireless Remote		Composite	\$1295
MC Jr Pro	1/2"	ICX418AKL-A	Yes	768 x 494	8.4µm x 9.8µm	1/10,000 – 100min	No	Wired Key Pad , Opt Wireless Remote	OSD	S-Video Composite	\$599.99
Astro- Video APU-1	1/3"	ICX672AKA EXview HAD	Yes	976 x 494	5.0mm x 7.4mm	1/100,00 – Infinity	Yes	Yes	976 x 494	Composite	\$569
Orion SSDSV Camera II	1/2"	72S85HN-EX-R	Yes	768 x 494	8.4µm x 9.8µm	1/10,000 – 4sec	No	OSD		Composite	\$549
MC Micro Or Astro- Video DSO-1	1/3"	ICX672AKA EXview HAD II	Yes	976 x 494	5.0mm x 7.4mm	1/100,00 – 17sec	No	OSD, Opt. Wired Remote or PC OSD, Opt. PC		Composite	\$99

Image Capture Setup



Imaging DSOs with a Video Camera

- Can capture multiple light, dark and flat frames for stacking and post processing like any CCD camera
- Can use a guide camera for long exposures
- Can use filters to enhance images ... LP, Narrow Band, etc.

- Live processing ... available with some SW
 - Accumulate and stack multiple frames live
 - Subtract dark frames on the fly
 - Create and apply amp glo filters live

Stacked & Stretched Images



M51 6 x 2min C9.25 ~ f/4.5 IR Filter
GSSP 7-2-2011



NGC 7635 Bubble Nebula 43 x 28sec C14
f/2 AGC 4 9-16-2012 CalStar



M82 7 x 4min C9.25 ~f/4.5 Guided
2-18-2012 Livermore, CA



NGC7293 43 x 28sec C14 f/2AGC 4
9-16-2012 CalStar

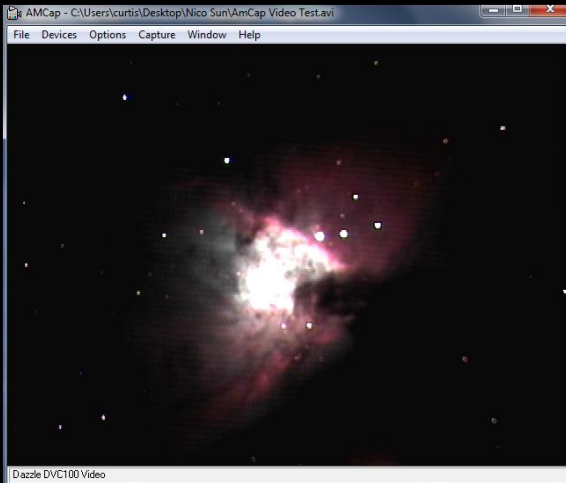
Stacked & Stretched M₃₁ & M₁₁₀



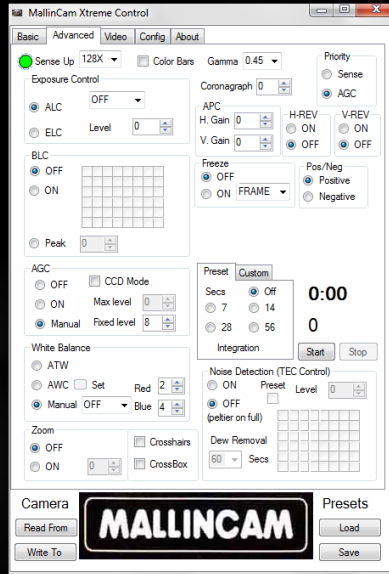
4X 1min $\gamma = 0.45$ Orion ED80 Astronomic CLS-CCD + IR
8/27/2011 Livermore, CA

Control & Capture Software

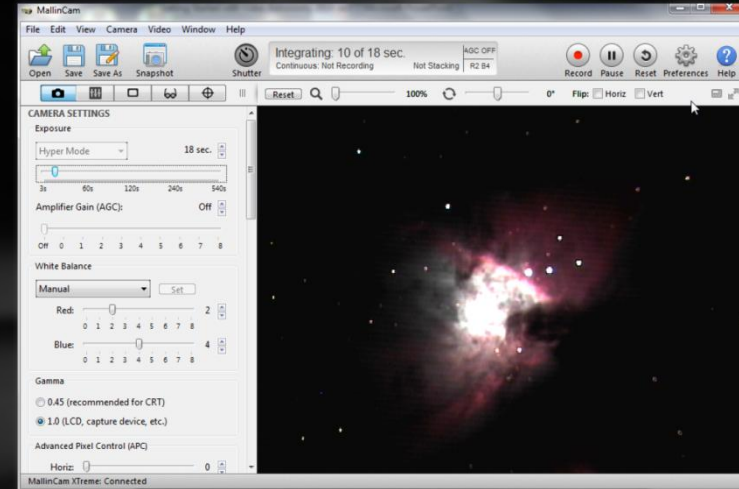
AMCap



MC Control

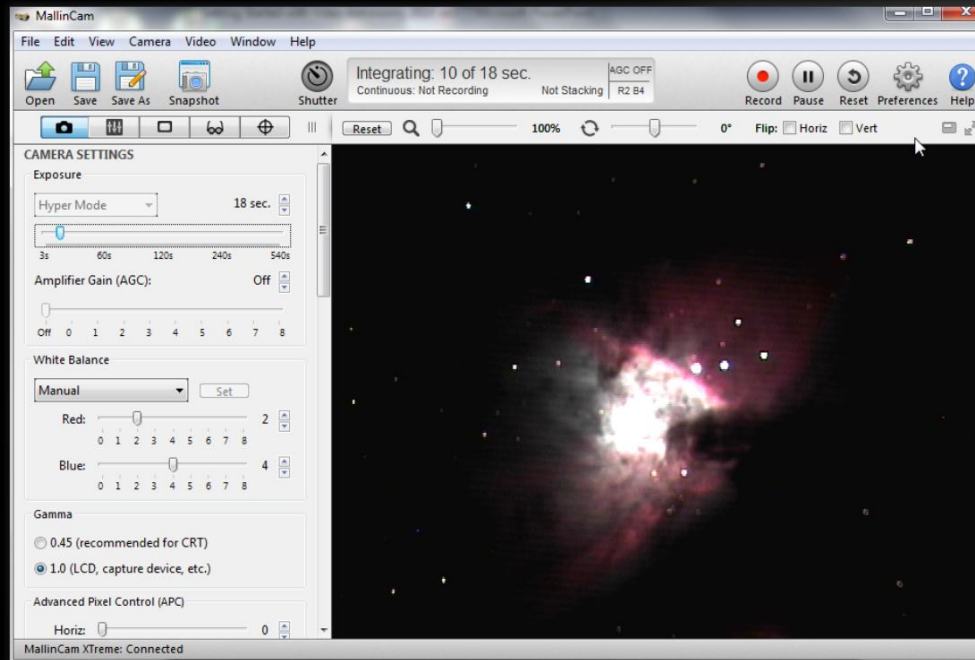


Miloslick



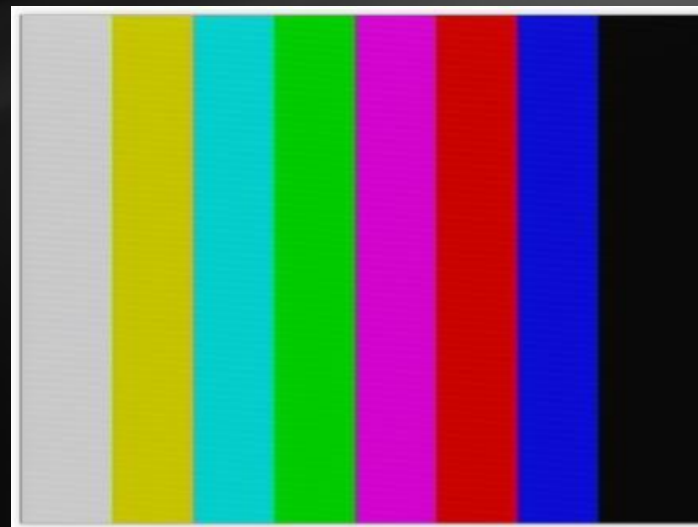
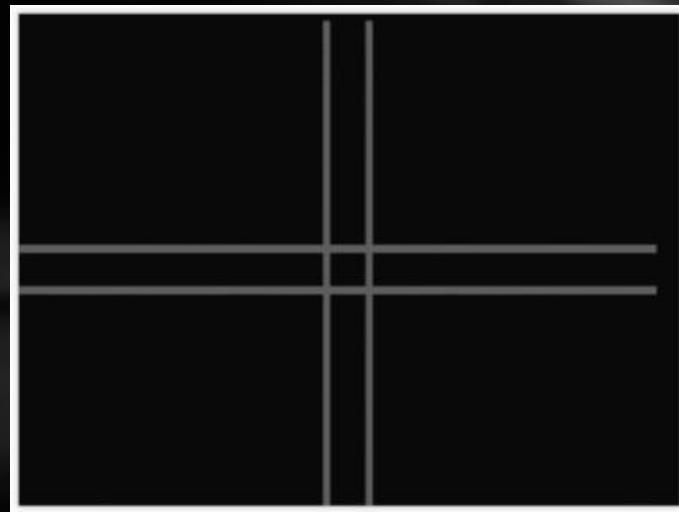
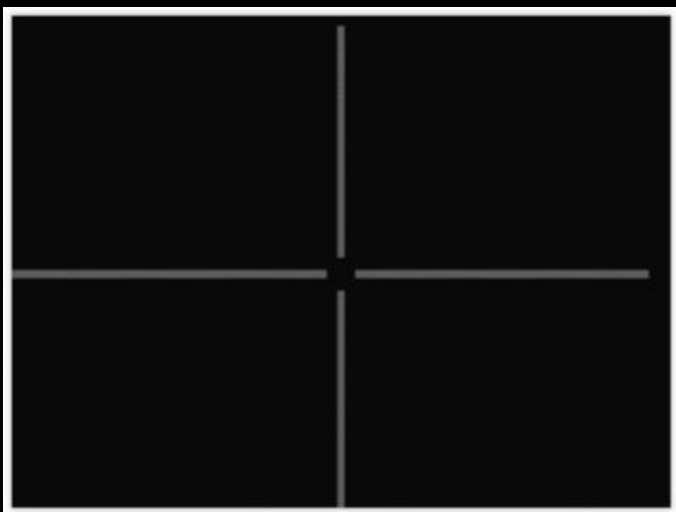
- Freeware
 - Image capture: AMCap, SharpCap, ManyCam, etc.
 - Camera control & image capture: MallinCam Control, Gstar, Orion
- Miloslick (\$49) ... for MC camera control, image display/capture, live processing
- AstroLive (\$69) ... multiple camera control, image display/capture, live processing, mount GoTo control & plate solve

Miloslick Control & Capture Software

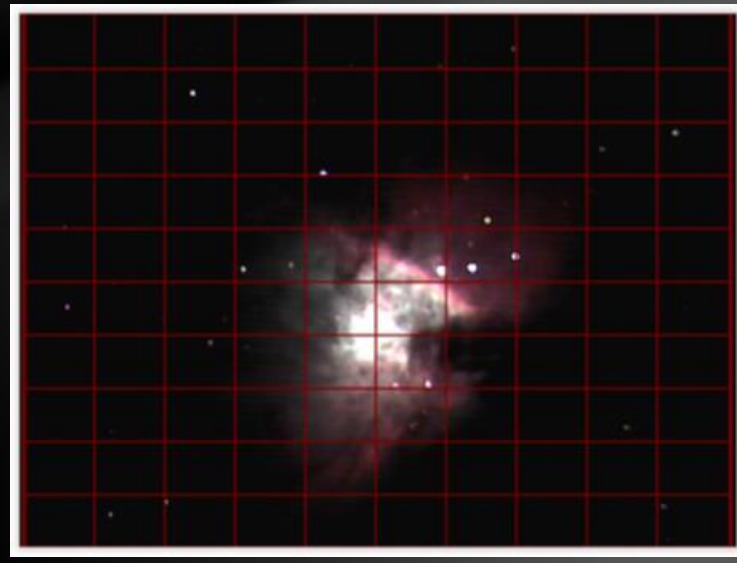
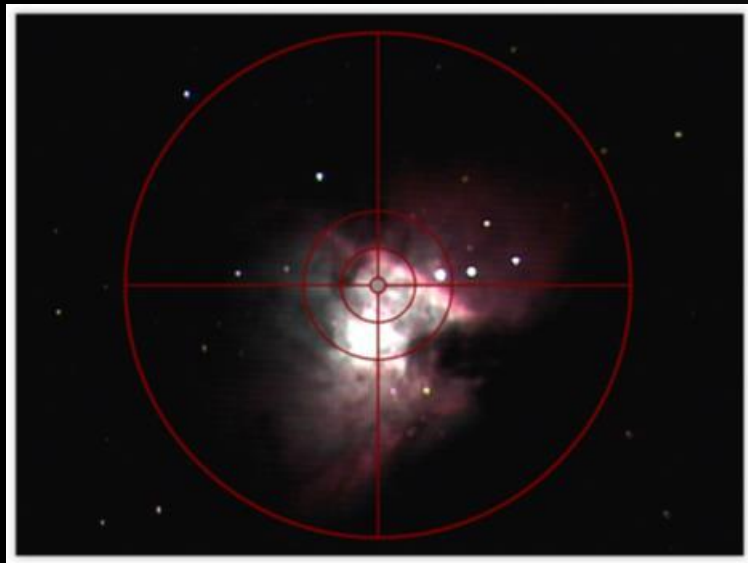
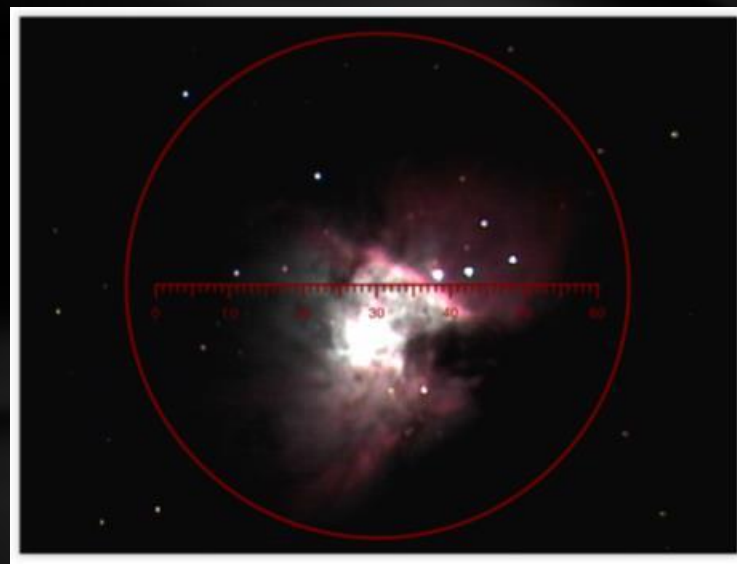
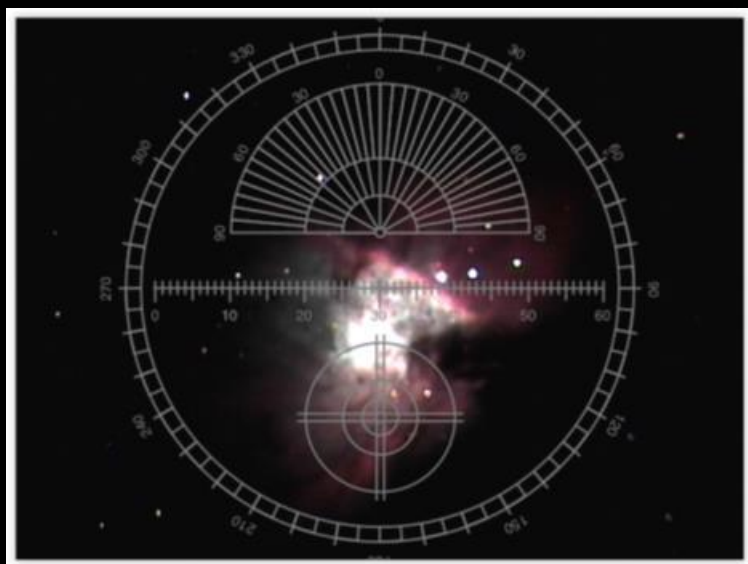


- Miloslick software for most MC models offers camera control, image capture, a variety of overlays for alignment and measurement, as well as, many image live processing features such as:
 - Stacking and/or averaging
 - Histograms for stretching
 - Amp glo and hot pixel filters
 - Dark frame subtraction

Miloslick Alignment Marks & Color Bar



Some Available Miloslick Overlays



Additional Resources

- *Deep Sky Video Astronomy* by Steve Massey & Steve Quirk, Springer 2009
- Yahoo Video Astro Group
- Yahoo Mallincam Group
- Cloudy Nights Video and Electronically Assisted Astronomy forum
- Night Skies Network <http://www.nightskiesnetwork.com/>
- Gstar-EX2 Basic 101 Tutorial: www.youtube.com/watch?v=beGEQRDHwsl
- Gstar-Ex2 Deep Sky 101 Tutorial: www.youtube.com/watch?v=jKeXnA3GFCI&feature=youtu.be
- AstroLive: www.astroprecisioninstruments.com

- Camera Vendors
 - Astro-Video Systems astro-video.com
 - Gstar myastroshop.com.au
 - Jack's Astro Accessories mallincamusa.com
 - Mallincam mallincam.tripod.com
 - Orion telescope.com
 - Stellacam cosmologicsystems.com

Additional Resources

- Video Capture Devices (S-Video/Composite/Component Video)
 - Astro-Video Systems HD (\$49)
 - KWorld USB Analog Video Capture (\$40 <http://www.altoedge.com/video/video-to-usb-dvd-maker.html>)
 - MallinCam MCV-1 HD and MCV-1-EHD (\$79.99 and \$149.99)
 - Pinnacle Dazzle DVD Recorder (\$65 Amazon)
- Serial to USB Adaptor
 - Keyspan by Tripp Lite USA 19HS (\$25 Amazon)
- 12V Powered USB Hub
 - StarTech 4 and 7 Port Industrial USB Hubs (\$47 and \$71 Amazon)
- Cables Zengineering <http://www.zengineering.us/>
- Software
 - AstroLive Camera Control/Capture/Live Processing/Mount Control (\$69 Astro Precision Instruments)
 - MallinCam Control for Camera Control/Capture (Free MallinCam Web Site)
 - Miloslick Camera Control/Capture/Live Processing (\$49 miloslick.com/MallinCam.html)

Additional Resources

- Focal Reducers

- Antares

- 0.63X SCT (\$89.95)
- 1.25" 0.5X (\$35)
- 2" 0.5X (\$50)

- Astro-Video- Systems VARIOREDUCER 1.25" 0.63 – 0.29X (\$99)

- Celestron 0.63X Reducer/Corrector SCT (\$129.95)

- Mallincam

- 1.25" 0.5X for 1/3" Chips (\$49.99)
- 2" 0.75X for RC Optics (\$189.99)
- 2" 0.5X (\$79.99)
- MFR3 1.25" 0.64X for Dob/Newtonian (\$139.95)
- MFR-5 1.25" Variable Reduction FR/Corrector 0.3X Min for Reflector/Refractor (\$249.95)
- MFR-6 1.25" 0.8X FR/Corrector (\$139.95)

- Color Monitors

- Astro-Video Systems Hi-Res 9" LCD Monitor (\$99)

- Mallincam

- 3.5" DVF LED LCD Monitor Kit (\$499.99)
- 8" LED LCD Monitor Kit (\$279.99)
- 12" & 15" LED LCD Monitors (\$329.99 & 389.99)
- Philips PD7012/37 7-Inch LCD Dual Screen Portable DVD Player (\$89.99)Amazon)
- Speeco VM905C 9" (~\$250 from various on-line security system retailers)