



# Deep Sky Imaging with a DSLR for FREE!

CAA  
26<sup>th</sup> June 2013

by  
Daniel Coe

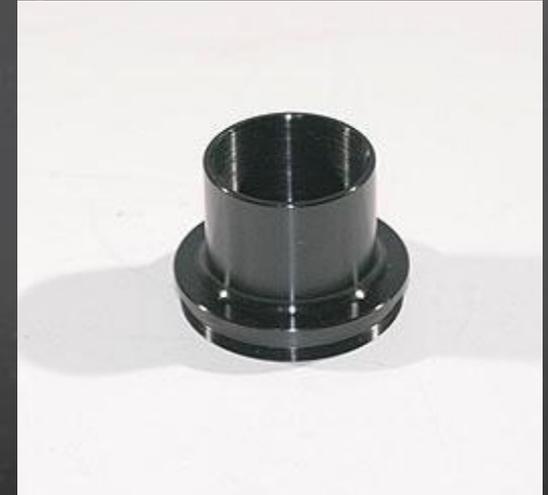
[www.astronomylog.co.uk](http://www.astronomylog.co.uk)

# Attaching the camera

DSLR

T-ring

1.25" or 2" nosepiece



Can't focus, not enough back focus, use an extension tube.



# Overview

## The 6\* F Program

- \* **F**ind & Choose the object - (Planetarium software, GoTo)
- \* **F**ocus - (DSLR – live view, Bahtinov masks, focusers)
- \* **F**rame – (CCD calculator)
- \* **F**ollow – (RA tracking, Polar Alignment, Autoguiding)
- \* **F**ilm – (Exposures, Dark & Flat Frames)
- \* **F**inish – (Calibrate, Stack, Align, Photoshop)

# Choose the Object

- Choose objects high in the sky
- Look in the monthly astronomy magazines for suggestions
- The 100 Best Astrophotography Targets Book by Springer
- Choose some easy targets to begin with – e.g.
  - M45 – Pleiades
  - M3 – Globular Cluster
  - M13 - Globular Cluster
  - M42 – Orion Nebula
  - M27 – Dumbbell Nebula

# Find the Object

M27 – Dumbbell Nebula (Now SE at Midnight)



# Find the Object

M27 – Dumbbell Nebula



130mm/5" Refractor, 13x5min Ha + OIII 10x3min on Atik 314L+ @ -10 deg

# Find the Object

M31 – Andromeda Galaxy



80mm refractor, 550d - ISO 1600, RAW (35mb a file), 14x5min, 19 deg

# Find the Object

M31 – Andromeda Galaxy



80mm refractor, LRGB (13,10,11,10 – 5min each), -15 deg

# Find the Object

- You need a tracking mount for Astrophotography, if you have GoTo on it, use it
- ‘Star Hop’ to your chosen subject if you know the sky well
- Planetarium software will give you the RA and Dec co-ordinates e.g. Cartes Du Ciel, Stellarium, Google Night Sky – all FREE
- Some objects can’t be seen with the naked eye, or with short exposures, so do a 5 second exposure image to see it

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- \* Finish – (Calibrate, Stack, Align, Photoshop)

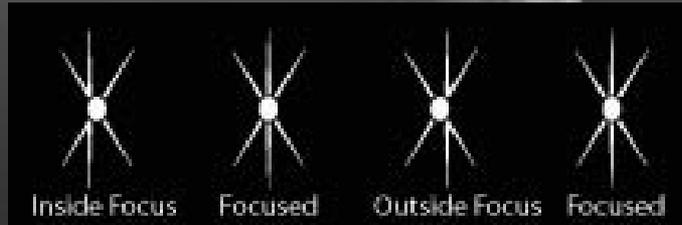
# Focus your Object

## DSLR

Try using the viewfinder

Use 'Live View' on LCD or through PC (Canon software)

Bahtinov Masks



Motor Focusers – DC Motor or Stepper Motor versions

Remember - Temperature changes focus

# Overview

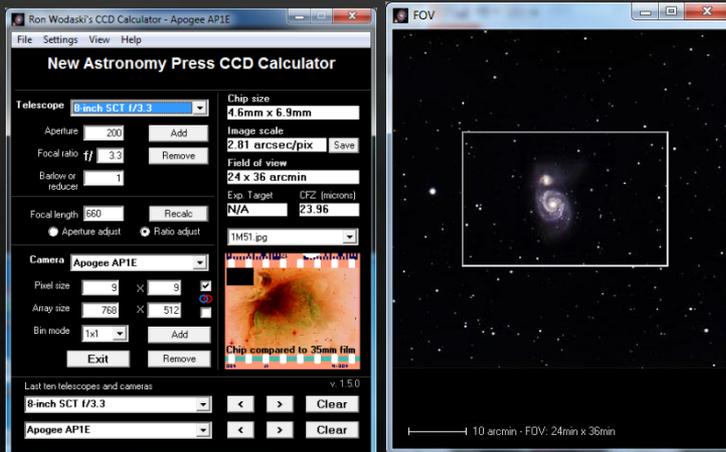
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# Frame your Object

- Centre the object on your camera, unless other objects exist in the frame
- Rotate your camera to fit the object in the FOV
- An imaging session may take more than 1 night
- Will the object be too big for your imaging set up? (focal reducer)
- Will the object be too small for your imaging set up? (barlow)

Check it with a free program like Cartes Du Ciel or CCD Calculator



# Overview

## The 6\* F Program

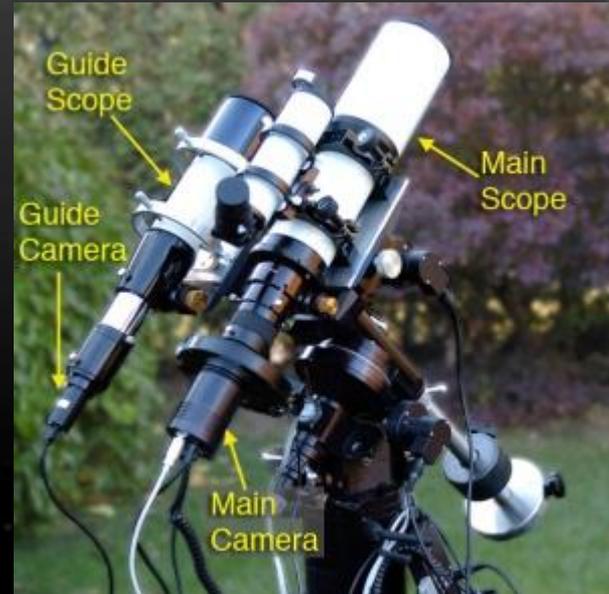
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# Follow your Object

## Autoguiding

Autoguiding uses a secondary CCD camera either connected to another telescope or even finderscope or connected to an off-axis guider, which is used to continuously image a 'test' star.

Any movements of the star on the secondary camera are then relayed to the main mount keeping it on target.



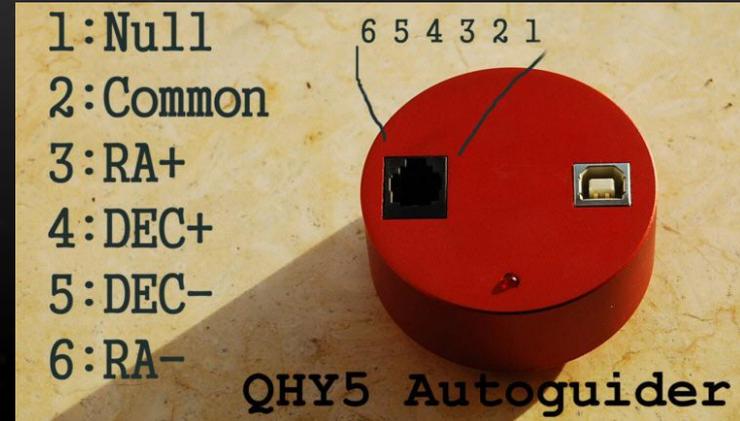
# Follow your Object

## Autoguiding

Cheap 2<sup>nd</sup> telescopes are fine, you can even adapt your finderscope.

Use a PC program like PHDguiding – which is excellent and free!

If not autoguiding, keep exposures to around 1-2 minutes.



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# Film your Object

## DSLR Users

- Beginners can start taking images in JPEG format (8bit)
- For more advanced users, set camera to take in RAW format (14bit)
- Set to ISO800 or ISO1600
- Set to Manual and Bulb mode if taking >30 second exposures
- Use a remote shutter release, manual or programmable
- Automate the imaging session by using computer software

## Capture Software

- Camera manufacturers own software - Free
- Maxim DL - £300
- APT – Astrophotography Tool - £10

# Film your Object

## Exposure Times – How long do I expose for?

Depends on several factors:

- Light pollution
- Tracking - do a test image to see how long your mount can track
- Sensor Noise
- Object Brightness
- Peripheral object brightness

If not autoguiding keep times to less than 2 minutes

If autoguiding typical times are between 3-5 minutes

Really it's down to trial and error!

What have other imagers used?

# Film your Object

How many exposures/subframes (individual images)?

- 5x1min subframes have same signal as 5min subframe, but long exposures can contain tracking errors etc.
- The more subframes you take the smoother the image
- Each subframe will be slightly different
- Staking the images together will increase 'signal-to-noise' ratio

DSLR Cameras: around 10-20 subframes

We call these 'Light' frames

# Film your Object

## Dark Frames

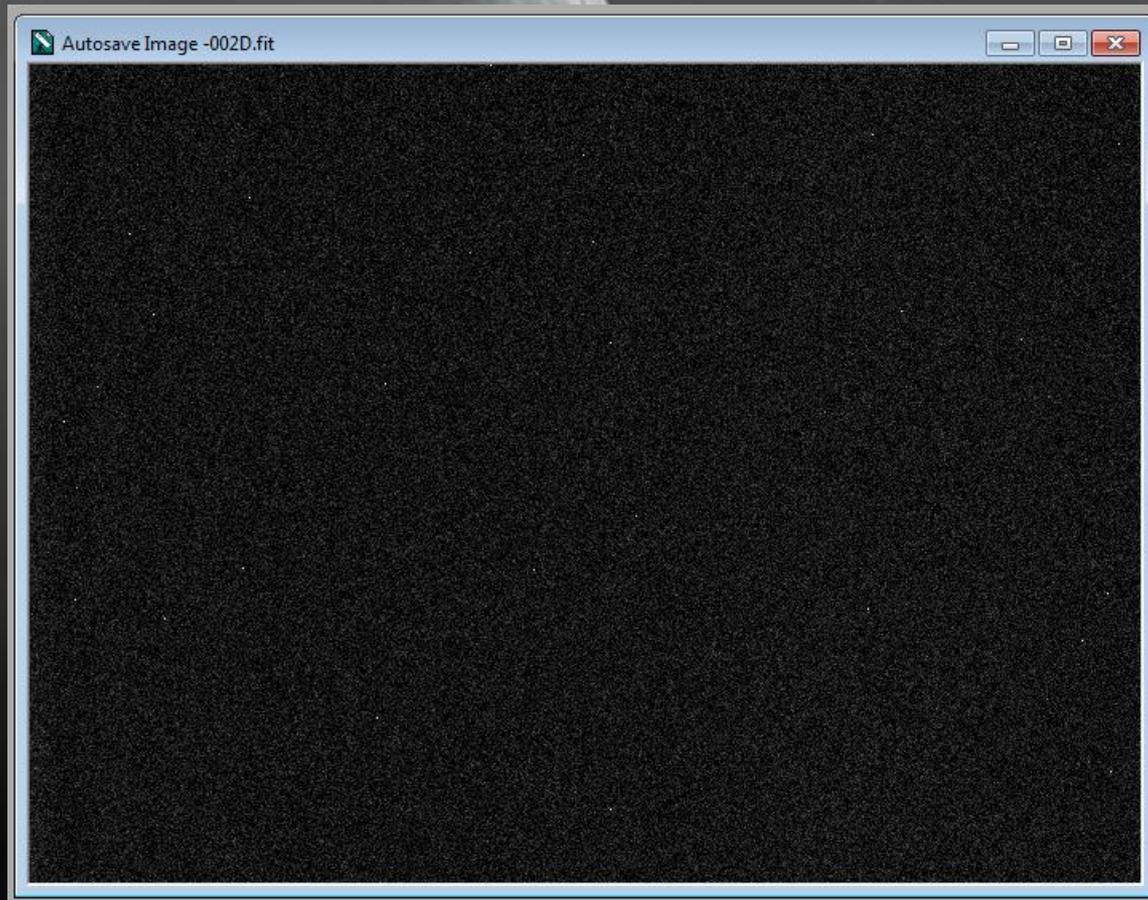
- A dark frame is an image of the same exposure length and temperature as the light frame with the front of the telescope capped off.
- The dark frame will contain noise from the sensor and any hot pixels.
- Take several dark frames, say 10. Then 'average combine' them in your processing software.
- Then subtract this dark image from your light image, which will remove a lot of the noise, known as 'Dark Frame Subtraction'.

OR

Try using 'Long exp. Noise Reduction' setting on your DSLR

Film your Object

Dark Frames



# Film your Object

## Flat Frames

A flat frame is an image taken at the same orientation as the camera, and at the same focus position as your light frames, but with an evenly illuminated but diffuse light source at the end of the telescope.

Some people use electro-luminescent panels, light boxes, white cloth.

The overall illumination needs to be at 30-50% of the saturation level of the sensor elements.

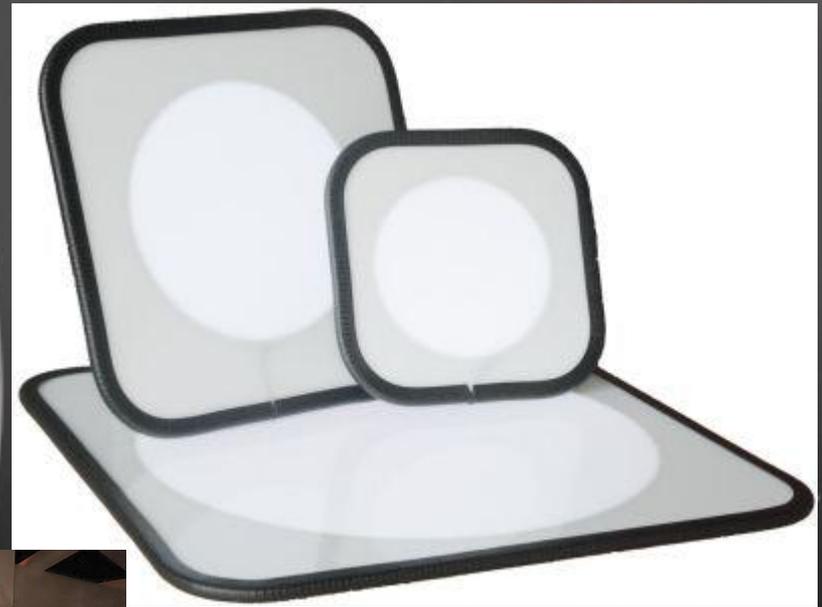
Take several flat frames, say 20.

The light frames will then remove 'dust doughnuts', vignetting and produce an evenly lit final image.

Vignetting is the reduction of image brightness at the edges of the frame caused by the lens design.

# Film your Object

## Flat Frames



# Film your Object

## Flat Frames



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# Finish your Object

**Image Processing** – This is where the work starts!

I use Maxim DL for capture, calibration, stacking and alignment and Photoshop to put the RGB frames together and manipulate the images

1. Discard low grade light frames – bad tracking, clouds, aircraft and satellite trails
2. Use Deep Sky Stacker – load light, dark and flat frames
3. Stack and Align
4. In Photoshop modify Levels, Curves, Sharpen, Reduce Noise, Crop etc.

# Finish your Object

## Image Processing Software

### Image Capture

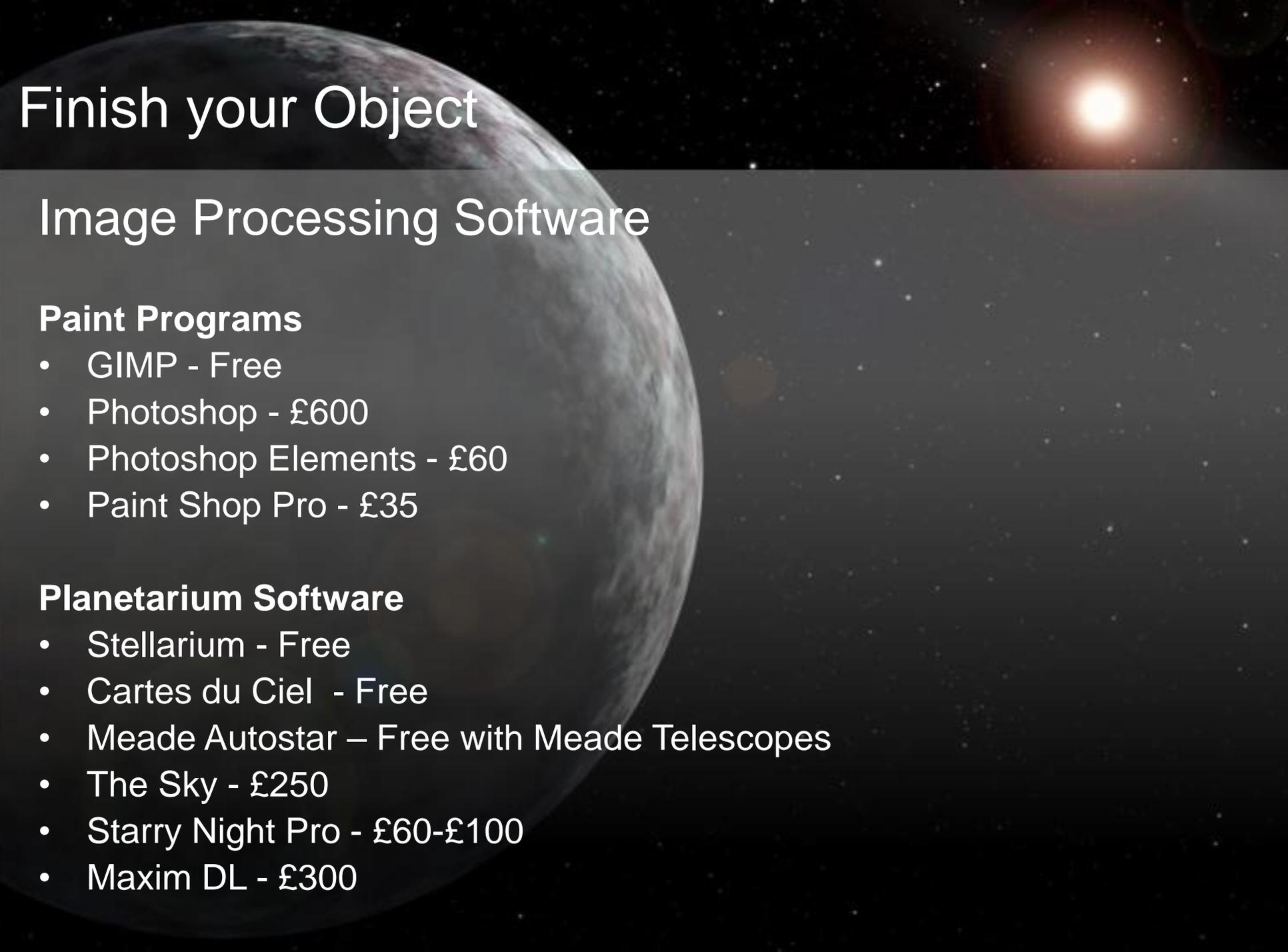
- Camera manufacturers own software - Free
- Maxim DL – £300
- APT - £10

### Autoguiding

- PHD Guiding – Free
- Maxim DL – £300

### Image Processing

- Deep Sky Stacker – Free
- Maxim DL – £300
- AstroArt - £110
- Nebulosity - £50
- CCDStack - £120
- PixInsight - £150



# Finish your Object

## Image Processing Software

### Paint Programs

- GIMP - Free
- Photoshop - £600
- Photoshop Elements - £60
- Paint Shop Pro - £35

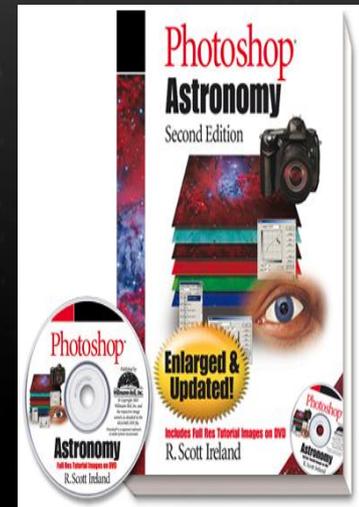
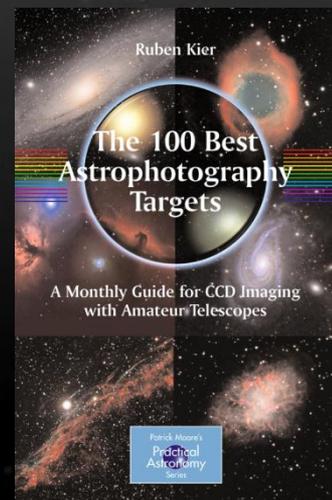
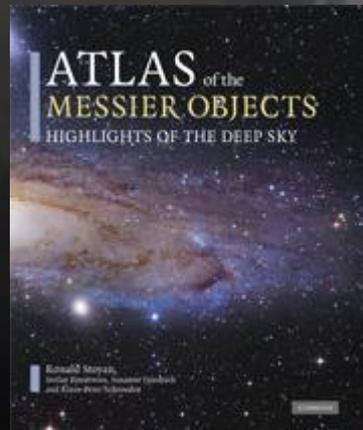
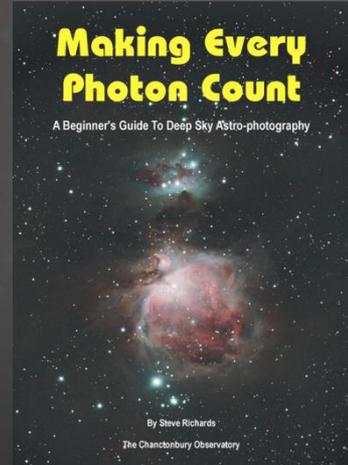
### Planetarium Software

- Stellarium - Free
- Cartes du Ciel - Free
- Meade Autostar – Free with Meade Telescopes
- The Sky - £250
- Starry Night Pro - £60-£100
- Maxim DL - £300

# Further Reading

- Making Every Photon Count by Steve Richards
- Digital SLR Astrophotography by Michael A Covington
- Atlas of the Messier Objects from Cambridge Univ. Press
- The 100 Best Astrophotography Targets by Ruben Kier
- Photoshop Astronomy by Scott Ireland

Check the CAA library!





Demo Time!



The End

[www.astronomylog.co.uk](http://www.astronomylog.co.uk)