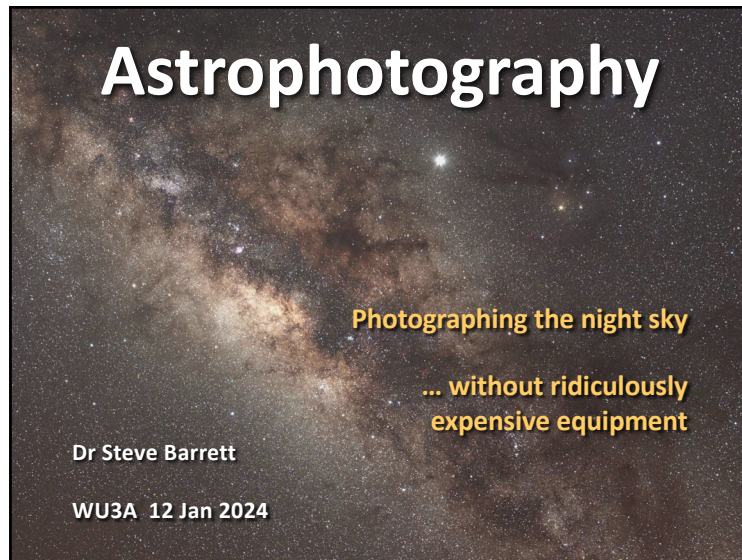


Astrophotography



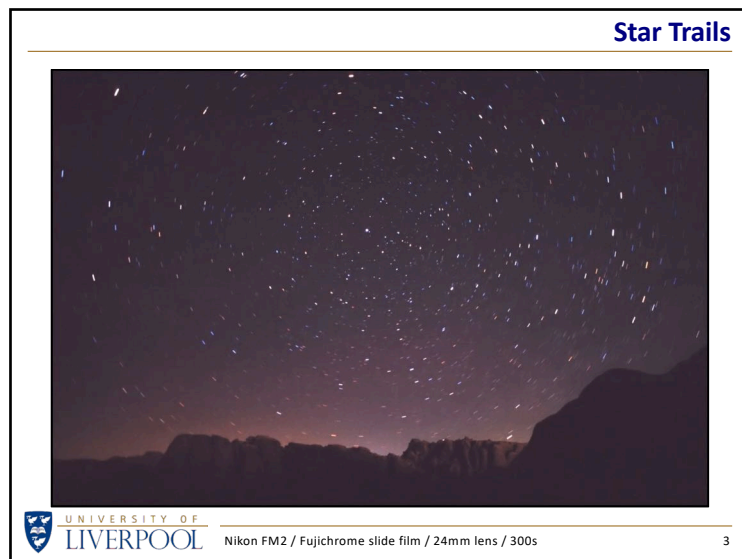
What Do You Need?

Start Simple	Just a camera and tripod
Equipment	Telescopes and mounts
Equipment	Cameras and star trackers
Photo Gallery	Some of my images
Astro Africa	Under the darkest skies

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2

This slide is titled 'What Do You Need?' in blue. It contains a table with five rows, each with a red header and a corresponding description. The University of Liverpool logo and the number '2' are at the bottom.



Astrophotography

Comet Holmes



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Nikon D200 / 300mm lens / 30s

5


Right Place ... Right Time



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Nikon FM2 / Fujichrome slide film / 24mm lens / 300s

6

Right Place ... Right Time



Total Eclipse – Sahara Desert – 29 Mar 2006

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Nikon D200 / 300mm lens / Various exposures

7

What Do You Need?

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Astrophotography

What Do You Need?



Keep an eye on eBay



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What Do You Need?

If you have a \$billion to spare ...



M51



M16



10

What Do You Need?

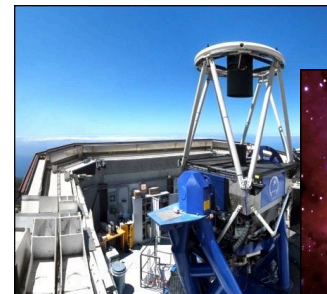
If you have a \$100 million to spare ...



11

What Do You Need?

If you have ~£million to spare ...



Liverpool Telescope, La Palma



M51



M16





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Astrophotography

What Do You Need?

If you have
~£250 – £25,000
to spare ...





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What Do You Need?

If you have
~£250 – £25,000
to spare ...



Turning a telescope into tech spaghetti

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What Do You Need?

If you have
~£250 – £25,000
to spare ...




Many astronomers would advocate the use of a telescope mount that is the most sturdy and most precise that you can afford.

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Where To Put the Telescope?



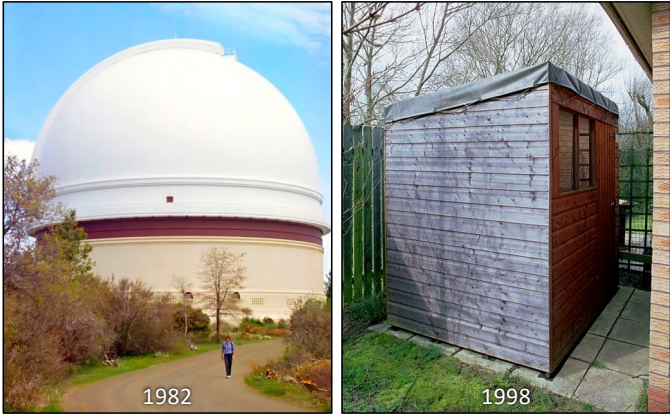
Palomar Mountain, California

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Astrophotography

Back Garden Observatory

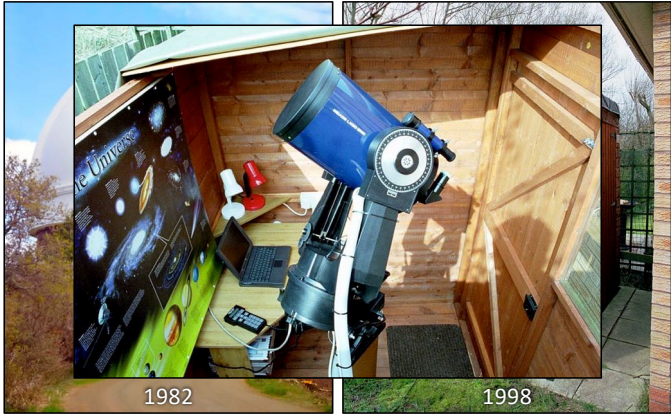


1982 1998

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Back Garden Observatory



1982 1998

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Our closest neighbour can be fascinating ...

... watching the shadows of the craters and mountains change from night to night

What Do You Need?

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Astrophotography

Colour Imaging

Monochromatic film or CCD chip

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Colour Imaging

Bayer grid

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Astronomical Cameras

2 Mpixel colour £250

7 Mpixel colour £2000

7 Mpixel mono £2000

Filter wheel £250 + filters £100 x n

Already got a DSLR?
Try a star tracker ...

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Star Trackers

DIY star tracker 'K2' that I designed and built
Used 2007-2013

Ioptron SkyTracker™
Used since 2015

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Astrophotography

Star Trackers



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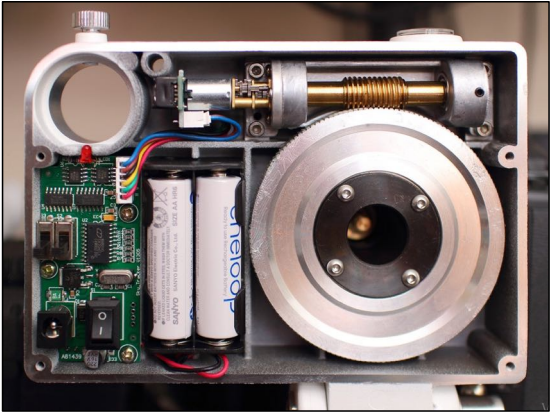
Star Trackers



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Inside a Star Tracker



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What Do You Need?

Start Simple	Just a camera and tripod
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Astrophotography

Some Of My Images

I like to take astrophotographs without using a telescope, just using a camera on a star tracker:

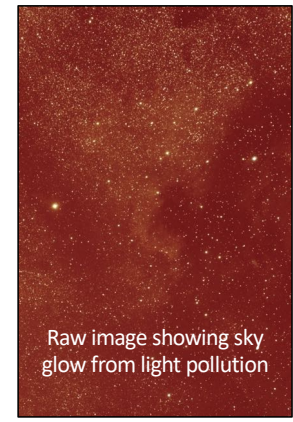


Astrophotography using a telescope can be very rewarding, but to get the most out of it will take quite a bit of time, effort and cash.

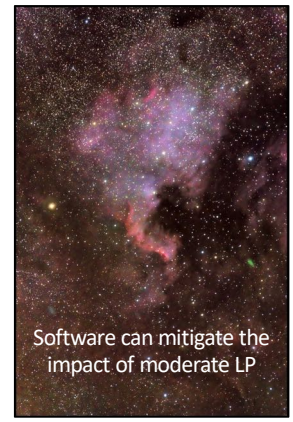


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Image Processing



Raw image showing sky glow from light pollution



Software can mitigate the impact of moderate LP



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Rosette Nebula



Nikon D7500 / 300mm lens / 110 x 30s

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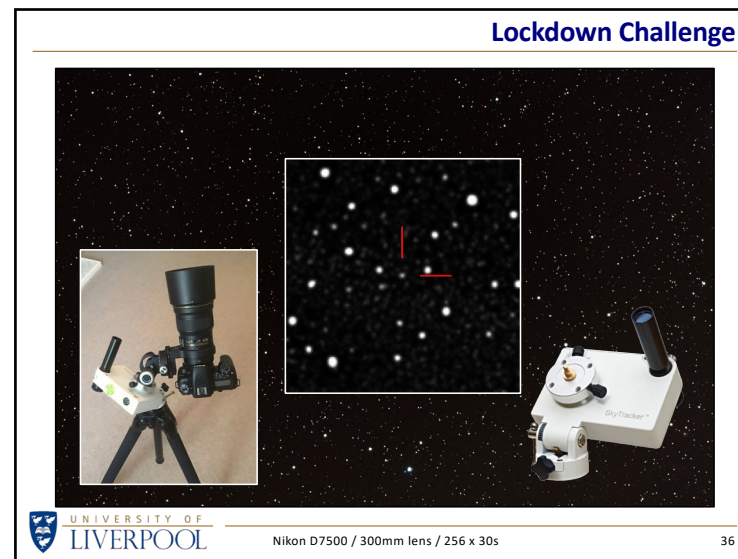
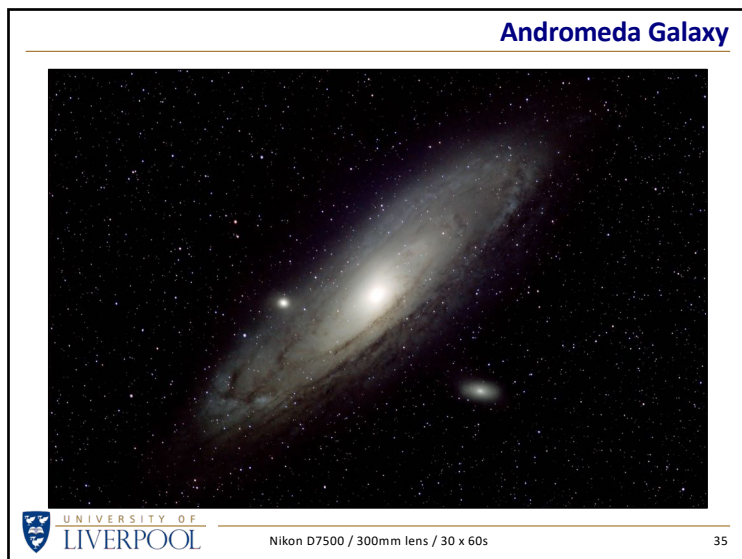
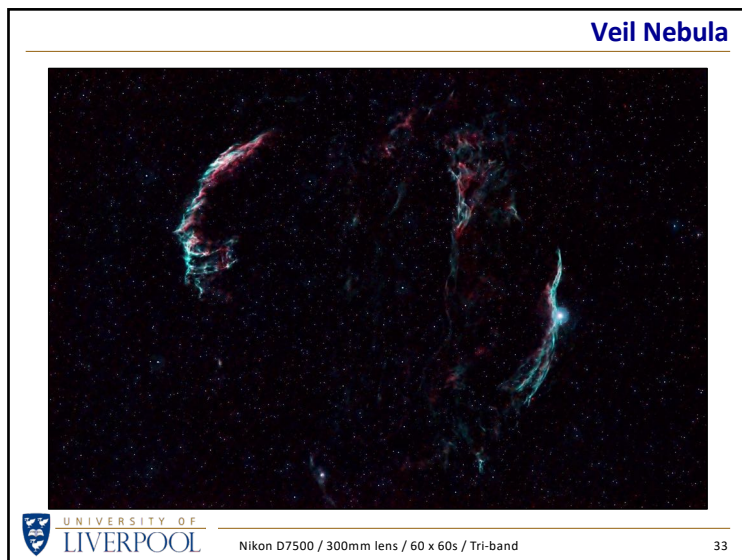
Carina Nebula



Nikon D7500 / 85mm lens / 15 x 60s

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Astrophotography



Astrophotography

Lockdown Challenge

Just a pixel of the 20 Megapixel image

Distance = 24.6 billion light-years Recession speed $\approx 2c$
 Look back time = 12.4 billion years = 90% of age of Universe

Most of the light from the quasar is focussed into one pixel!

UNIVERSITY OF LIVERPOOL Nikon D7500 / 300mm lens / 256 x 30s 37

What Do You Need?

- Start Simple** Just a camera and tripod
- Equipment** Telescopes and mounts
- Equipment** Cameras and star trackers
- Photo Gallery** Some of my images
- Astro Africa** Under the darkest skies

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Wild Astronomy

Animals by day stars by night

Wildlife Safari! Astronomy

Photography

(Sleep when you get home)

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Aligning Using Polaris

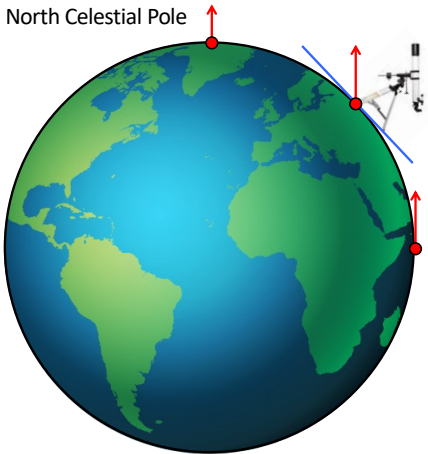
With Polaris visible, aligning a star tracker is easy in the UK.

But ...

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Astrophotography

Aligning a Star Tracker




North Celestial Pole

In East Africa the NCP and Polaris are very close to the horizon, and hence are hidden behind elephants or distant hills.

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Large Magellanic Cloud



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Nikon D7100 / 85mm lens / 30 x 60s

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Milky Way



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Nikon D7500 / 35mm lens / 10 x 120s

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Milky Way



ISO 200
Slide film
Untracked

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Nikon D7500 / 35mm lens / 10 x 120s

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Astrophotography

