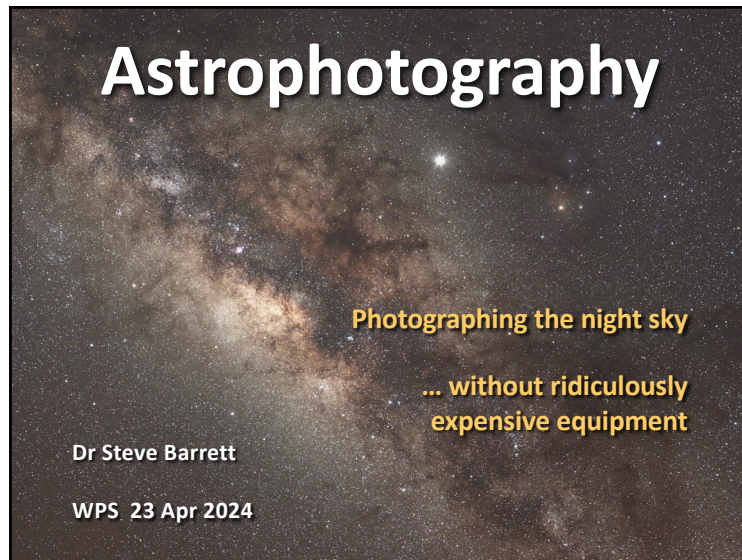


Astrophotography

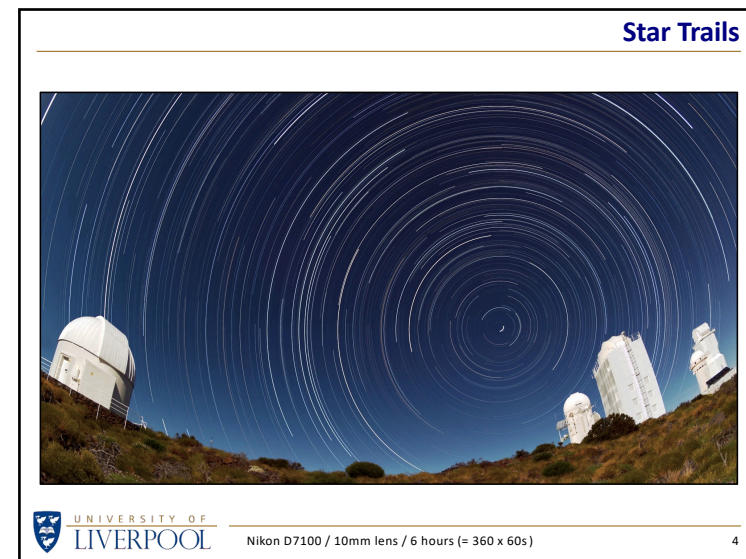
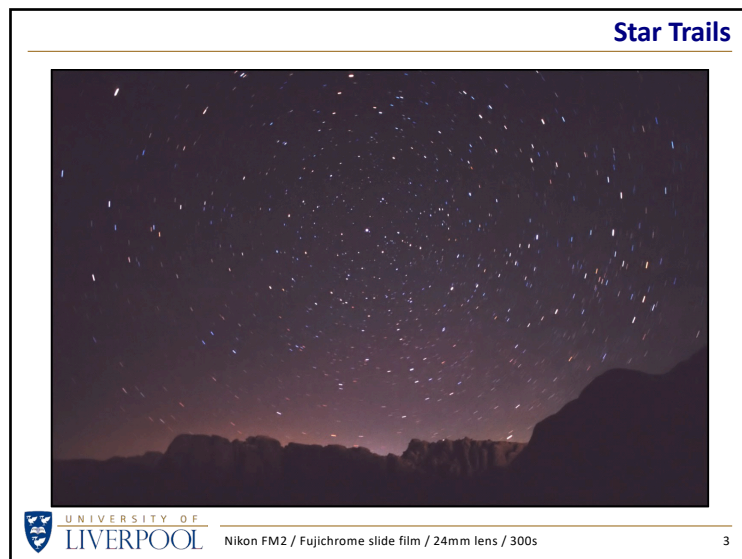


What Do You Need?

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

UNIVERSITY OF LIVERPOOL

2



Astrophotography

Comet Holmes



Nikon D200 / 300mm lens / 30s

5

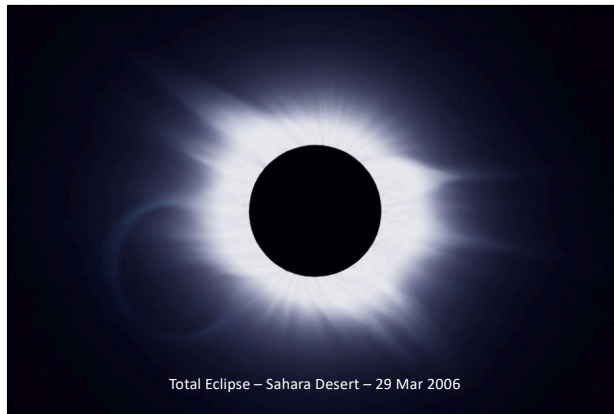
Right Place ... Right Time



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

6

Right Place ... Right Time



Total Eclipse – Sahara Desert – 29 Mar 2006



Nikon D200 / 300mm lens / Various exposures

7

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



8

Astrophotography

What Do You Need?



Keep an eye on eBay

What Do You Need?

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



M51



M16

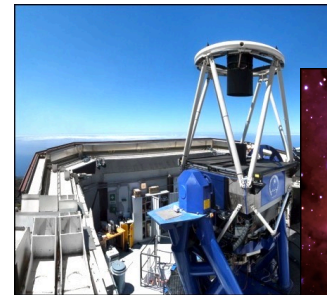
What Do You Need?

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

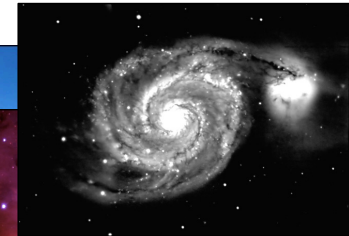


What Do You Need?

If you have ~£million to spare ...



Liverpool Telescope, La Palma



M51



M16

Astrophotography

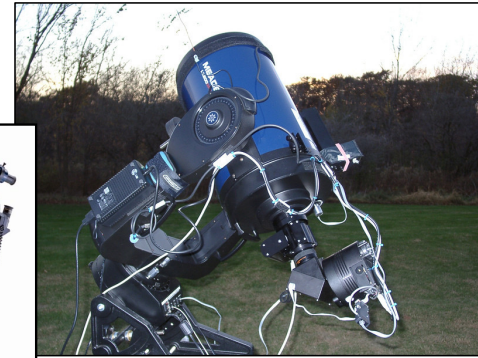
What Do You Need?

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



What Do You Need?

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



Turning a telescope into tech spaghetti

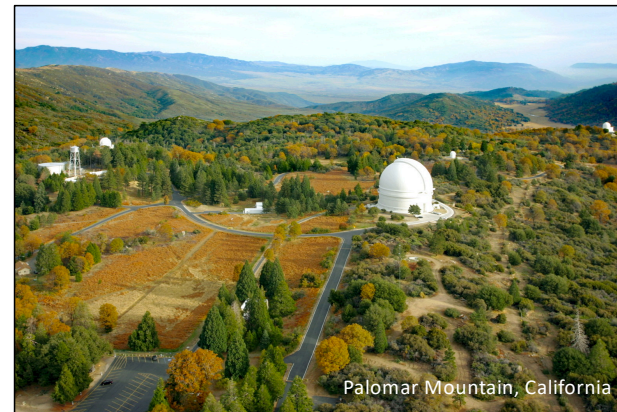
What Do You Need?

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.

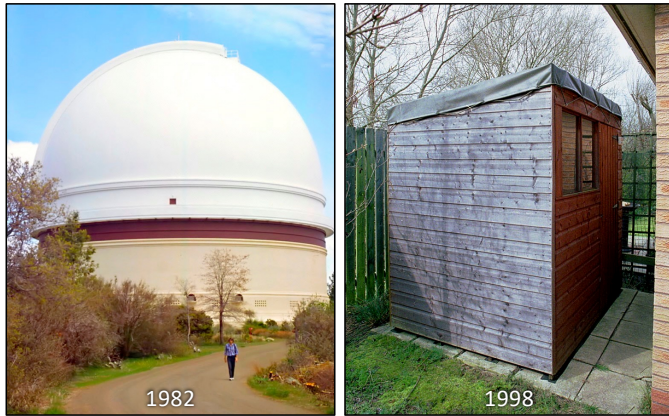
Where To Put the Telescope?



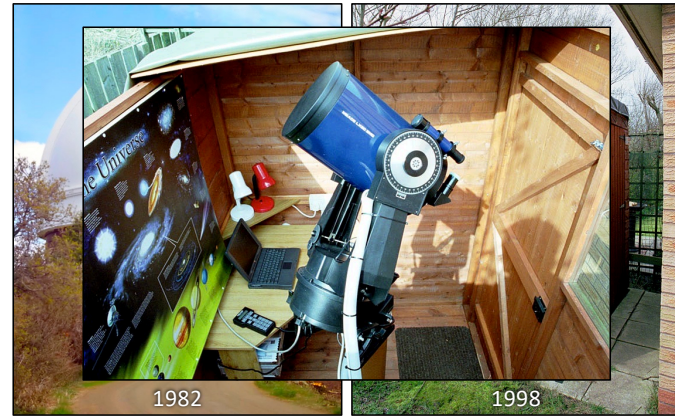
Palomar Mountain, California

Astrophotography

Back Garden Observatory



Back Garden Observatory



Our closest
neighbour can
be fascinating ...

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

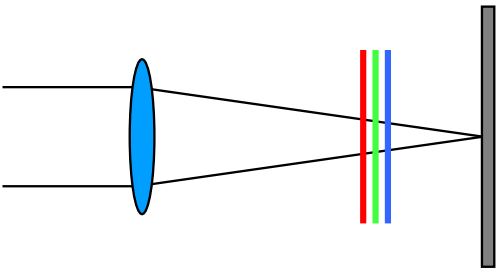


What Do You Need?

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

Astrophotography

Colour Imaging

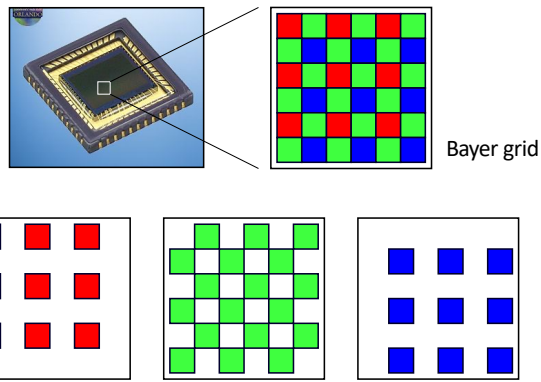


Monochromatic film or CCD chip

UNIVERSITY OF LIVERPOOL

21

Colour Imaging



Bayer grid

UNIVERSITY OF LIVERPOOL

22

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 ...

UNIVERSITY OF LIVERPOOL

23

Star Trackers



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



iOptron SkyTracker™
Used since 2015

UNIVERSITY OF LIVERPOOL

24

Astrophotography

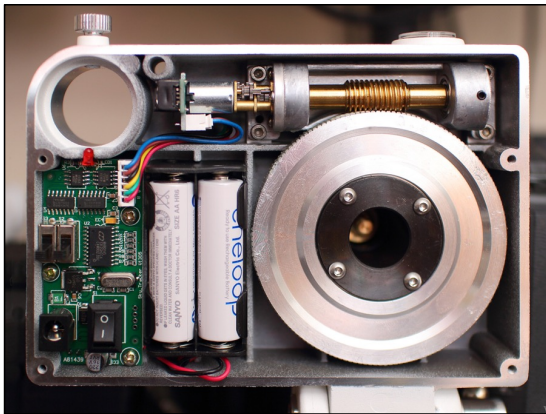
Star Trackers



Star Trackers



Inside a Star Tracker



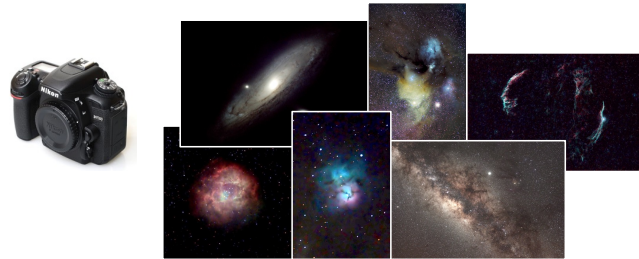
What Do You Need?

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

Astrophotography

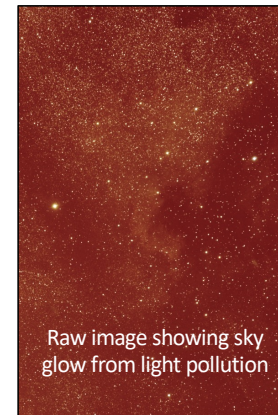
Some Of My Images

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.

Image Processing

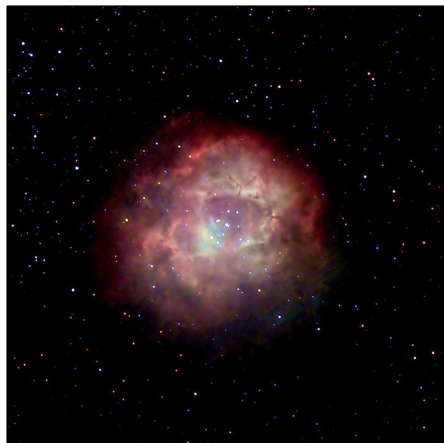


Raw image showing sky
glow from light pollution

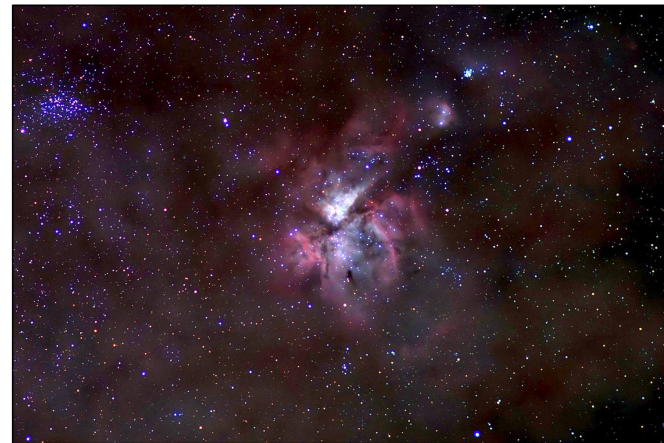


Software can mitigate the
impact of moderate LP

Rosette Nebula

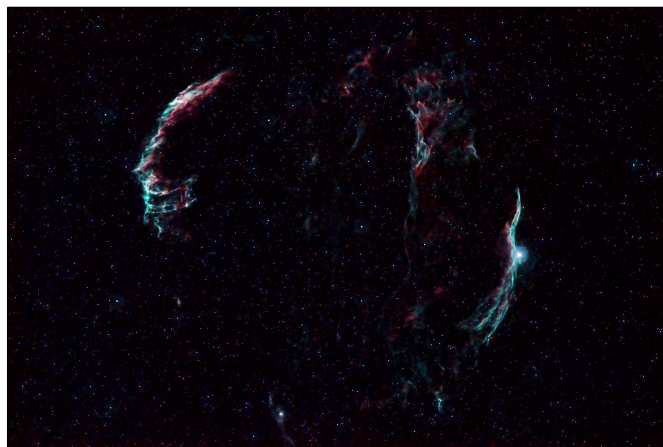


Carina Nebula



Astrophotography

Veil Nebula



Nikon D7500 / 300mm lens / 60 x 60s / Tri-band

33

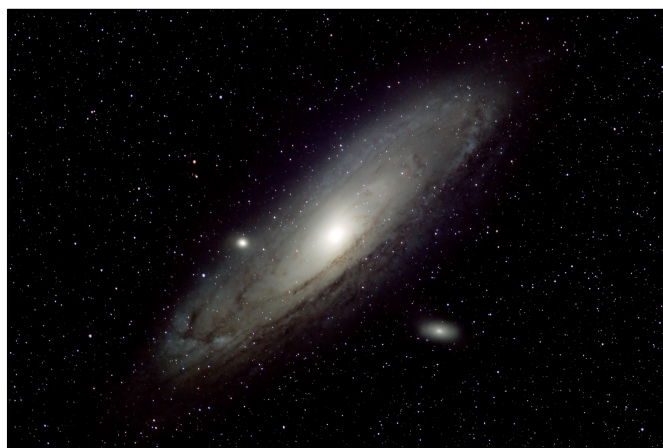
Stars and Stuff



Nikon D7500 / 135mm lens / 60 x 120s

34

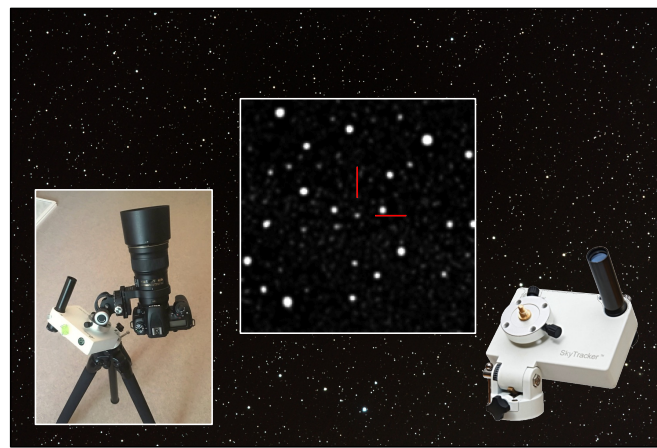
Andromeda Galaxy



Nikon D7500 / 300mm lens / 30 x 60s

35

Lockdown Challenge

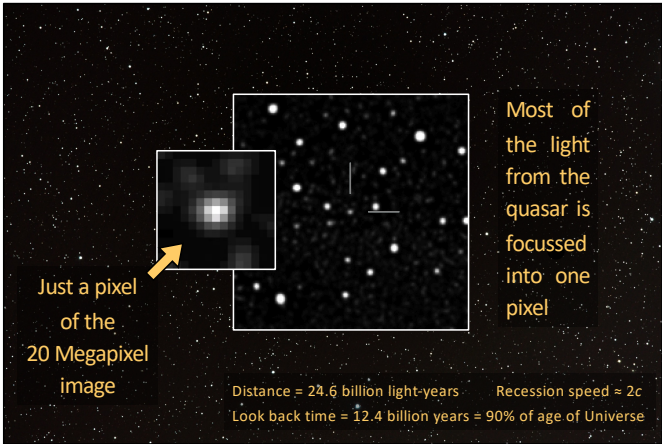


Nikon D7500 / 300mm lens / 256 x 30s

36

Astrophotography

Lockdown Challenge



Just a pixel of the 20 Megapixel image

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

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

UNIVERSITY OF LIVERPOOL

Nikon D7500 / 300mm lens / 256 x 30s

37

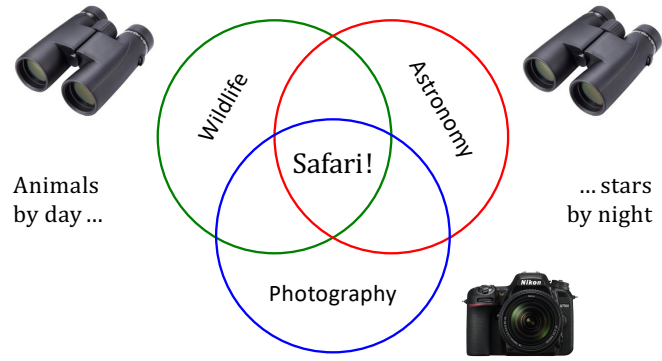
What Do You Need?

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

UNIVERSITY OF LIVERPOOL

38

Wild Astronomy



Animals by day ...

Wildlife

Astronomy

Photography

Safari!

... stars by night

(Sleep when you get home)

UNIVERSITY OF LIVERPOOL

39

Aligning Using Polaris

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



But ...

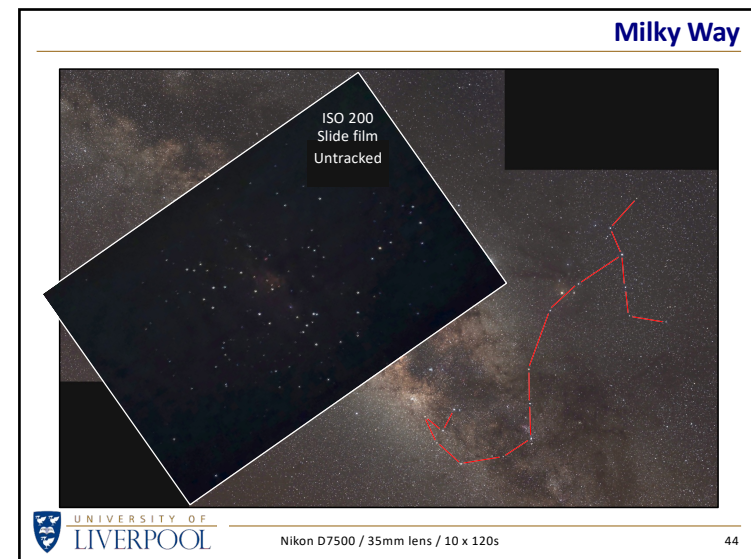
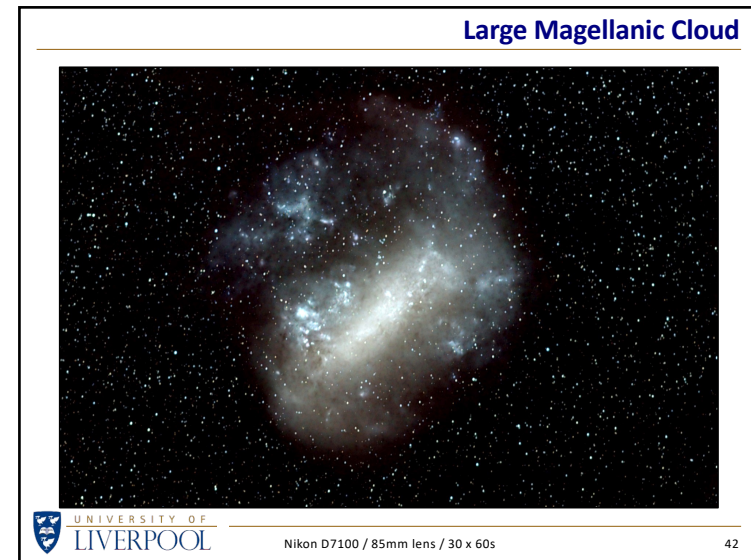
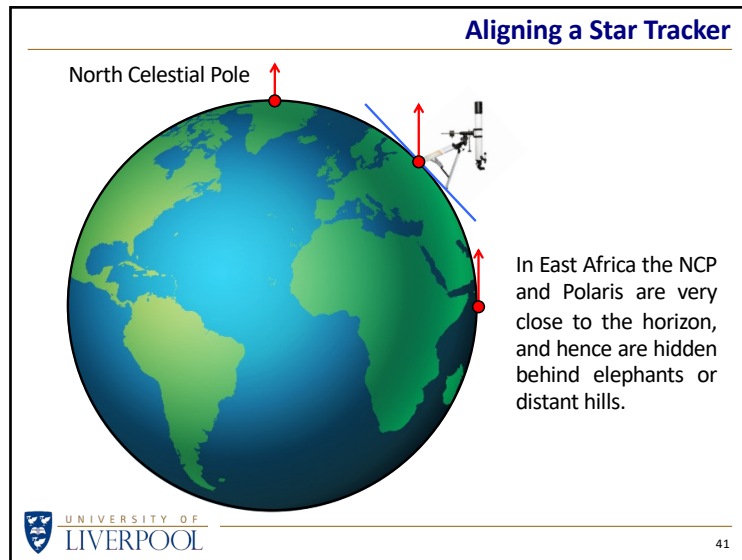


Local Time: 2019-04-02 11:26:53
Longitude: 002°57'47" W
Latitude: 53°24'14" N
Elevation: 0049 m
Temperature: 7.2 °C
Barometric Pressure: 99587 Pa
Position of Polaris:
08h 22.0m
Radius: 39.2 arcmin

UNIVERSITY OF LIVERPOOL

40

Astrophotography



Astrophotography

