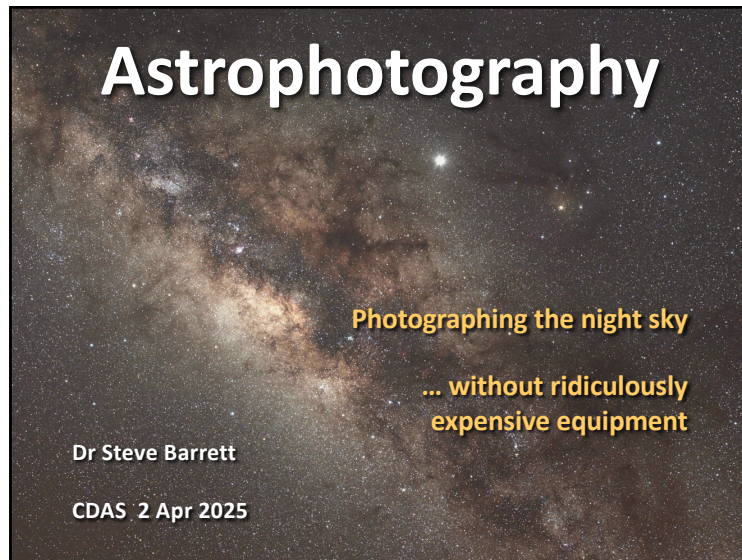


# Astrophotography

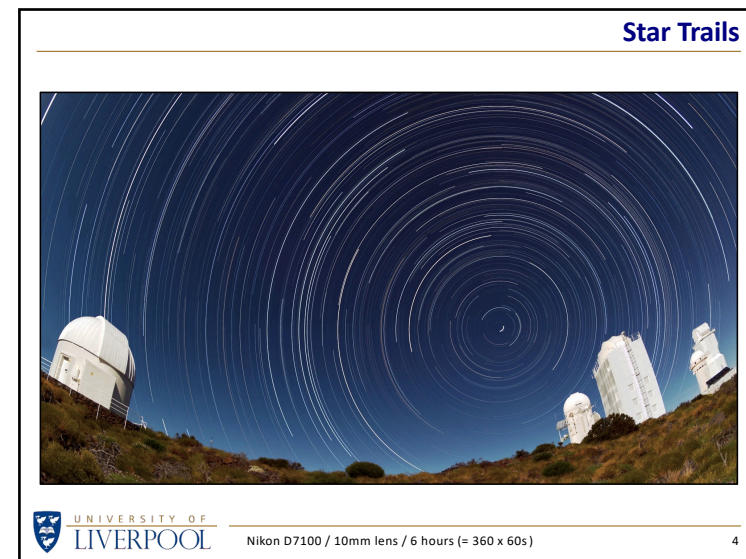
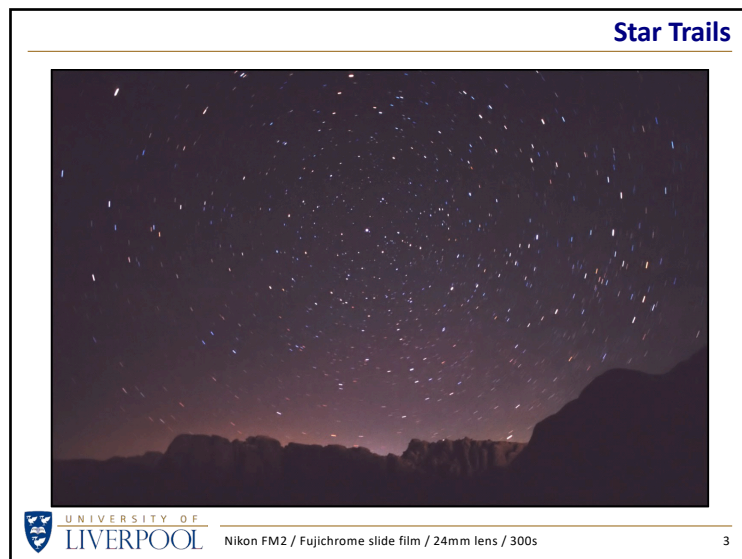


## What Do You Need?

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

UNIVERSITY OF LIVERPOOL

2



# Astrophotography

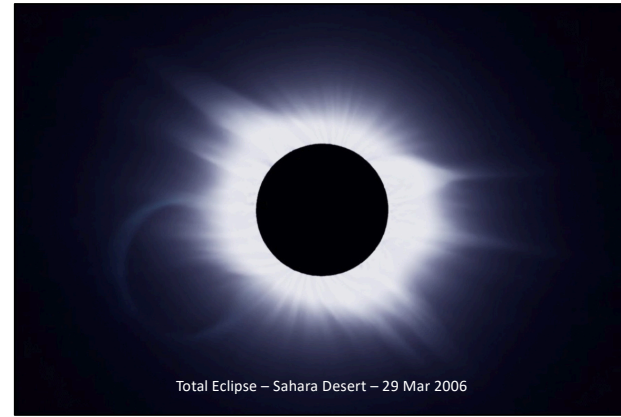
## Right Place ... Right Time



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

5

## Right Place ... Right Time



Total Eclipse – Sahara Desert – 29 Mar 2006



Nikon D200 / 300mm lens / Various exposures

6

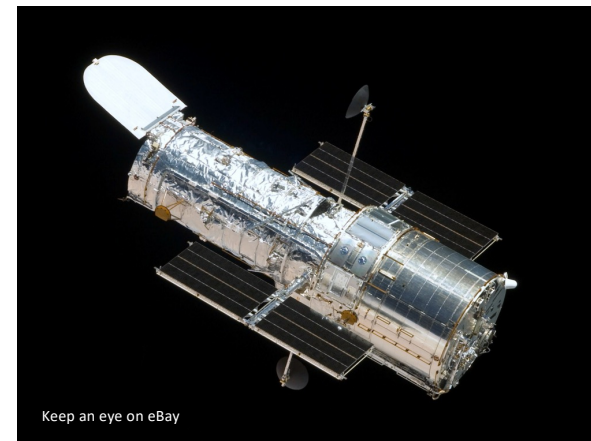
## What Do You Need?

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



7

## What Do You Need?



Keep an eye on eBay



8

# Astrophotography

## What Do You Need?

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



M51



M16

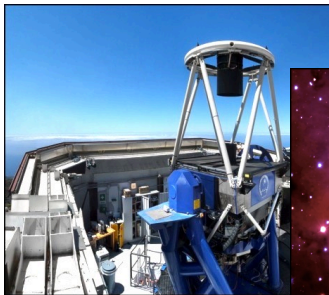
## What Do You Need?

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

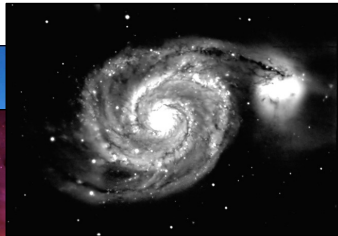


## What Do You Need?

If you have ~£million to spare ...



Liverpool Telescope, La Palma



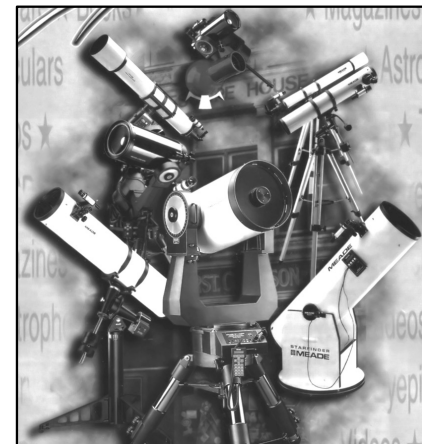
M51



M16

## What Do You Need?

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

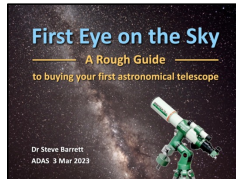




# Astrophotography

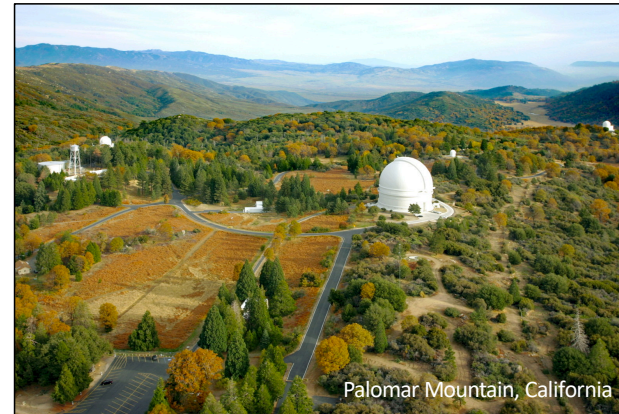
## What Do You Need?

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. Is this mount worth \$10,000?

## Where To Put the Telescope?



Palomar Mountain, California

## Back Garden Observatory

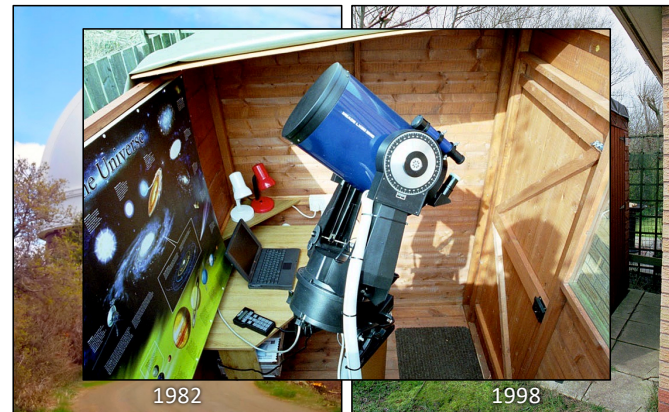


1982



1998

## Back Garden Observatory

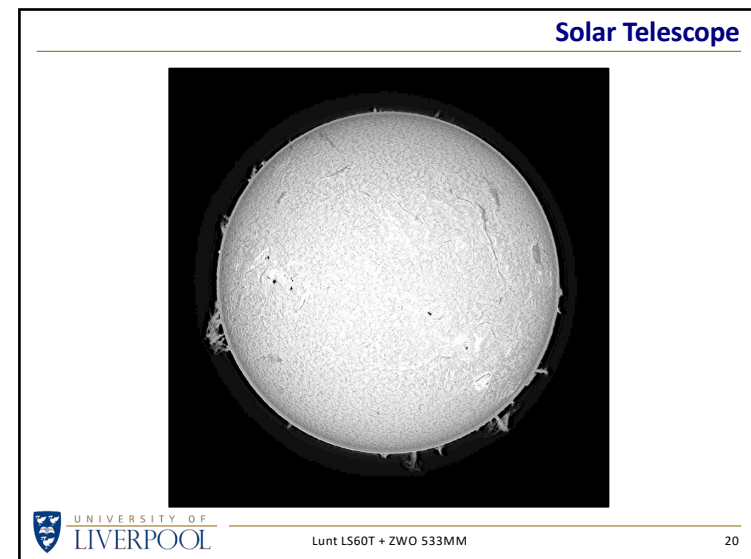
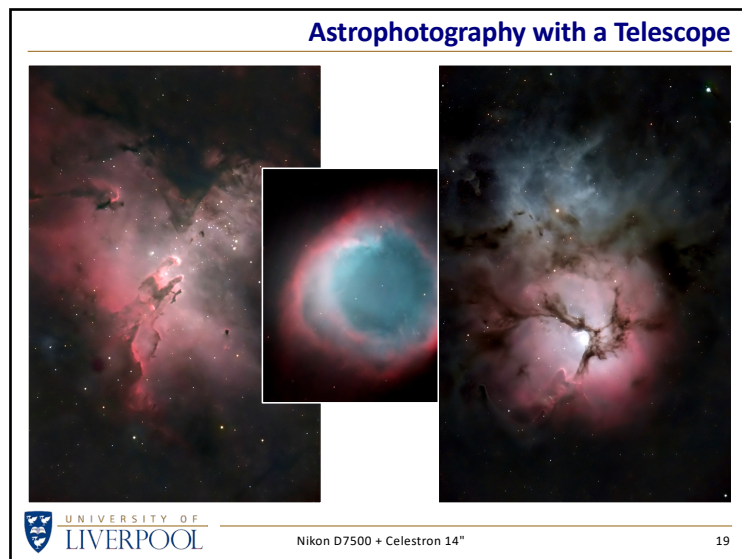
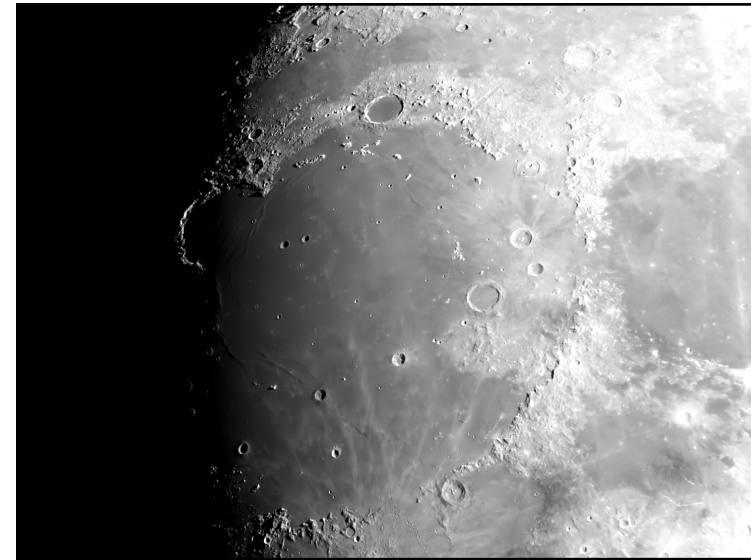


1982

1998



# Astrophotography

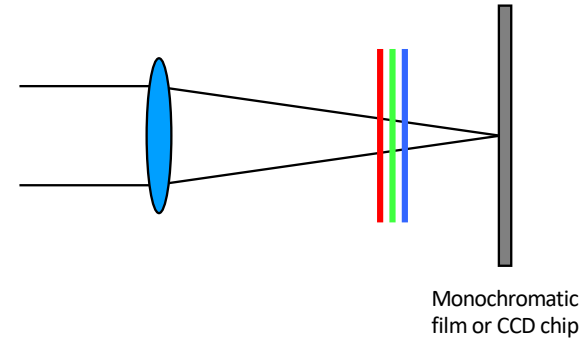


# Astrophotography

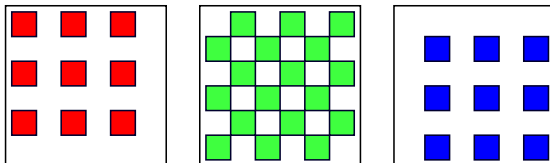
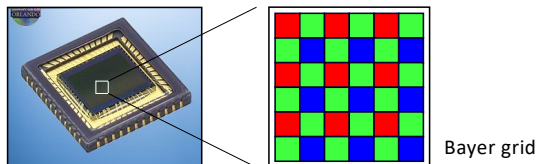
## What Do You Need?

<b>Start Simple</b>	Just a camera and tripod
<b>Equipment</b>	Telescopes and mounts
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<b>Photo Gallery</b>	Some of my images
<b>Astro Africa</b>	Under the darkest skies

## Colour Imaging



## Colour Imaging



## Astronomical Cameras

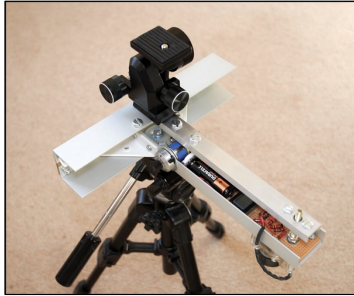


Already got a DSLR?  
Try a star tracker ...



# Astrophotography

## Star Trackers

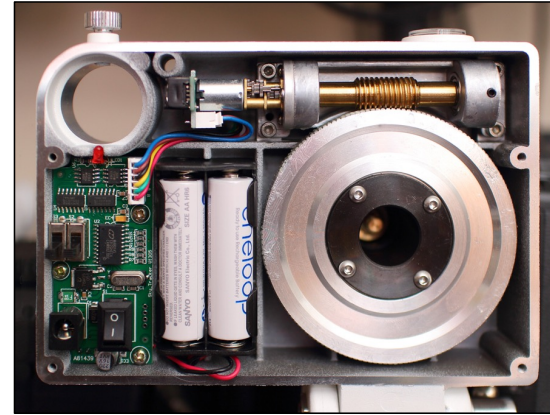


DIY star tracker 'K2' that I designed and built  
Used 2007–2013

iOptron SkyTracker™  
Used since 2015



## Inside a Star Tracker



## Star Trackers



## Camera and Lens



Nikon D7500  
300 mm f/4 lens



# Astrophotography

## What Do You Need?

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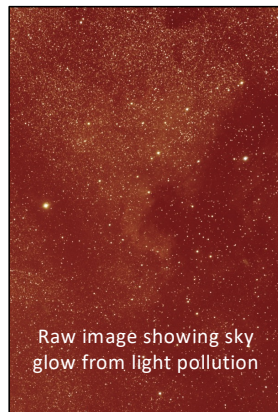
## Some Of My Images

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

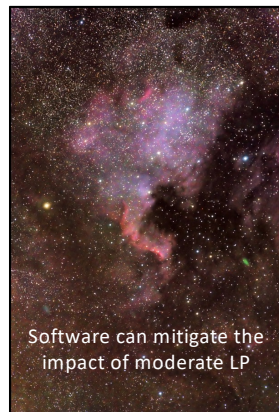


Astrophotography using a telescope can be very rewarding, but to get the most out of it will take quite a bit of time, effort and cash.

## Image Processing

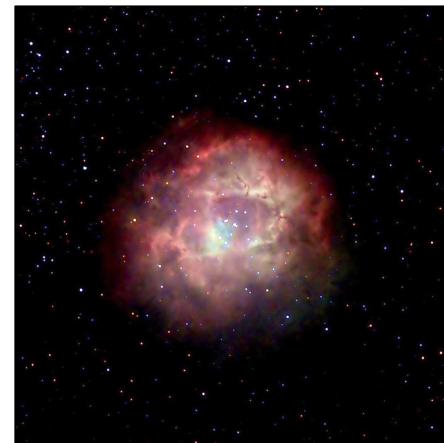


Raw image showing sky glow from light pollution



Software can mitigate the impact of moderate LP

## Rosette Nebula

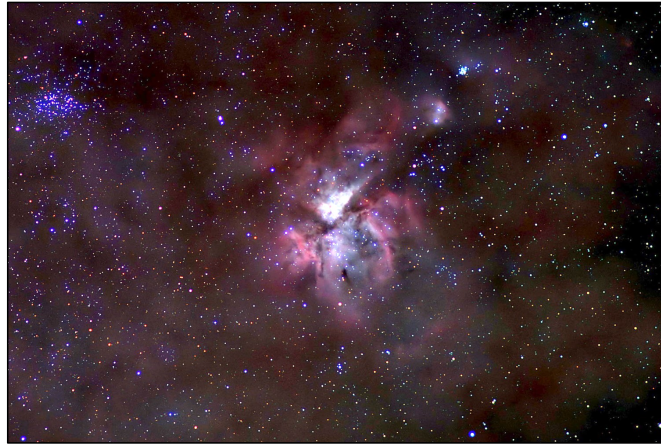


Nikon D7500 / 300mm lens / 110 x 30s



# Astrophotography

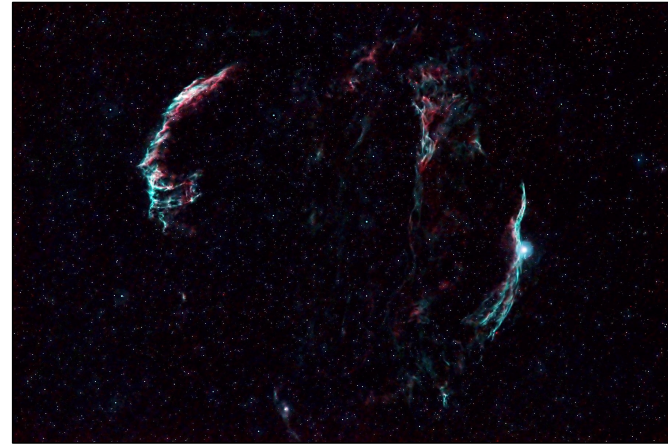
Carina Nebula



Nikon D7500 / 85mm lens / 15 x 60s

33

Veil Nebula



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

34

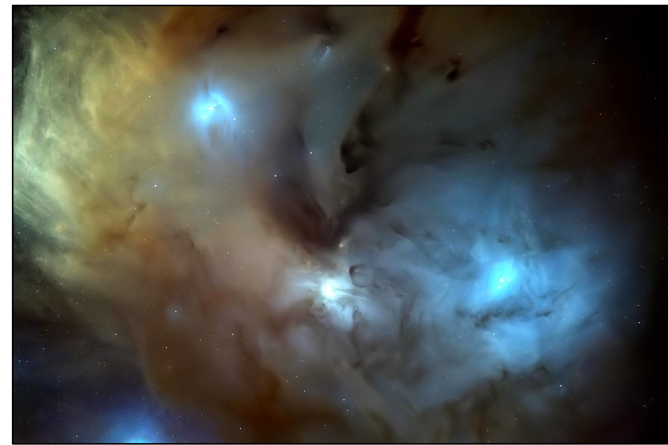
Stars and Nebulae



Nikon D7500 / 135mm lens / 60 x 120s

35

Stars and Nebulae



Nikon D7500 / 300mm lens / 150 x 60s

36

# Astrophotography

Andromeda Galaxy



Nikon D7500 / 300mm lens / 30 x 60s

37

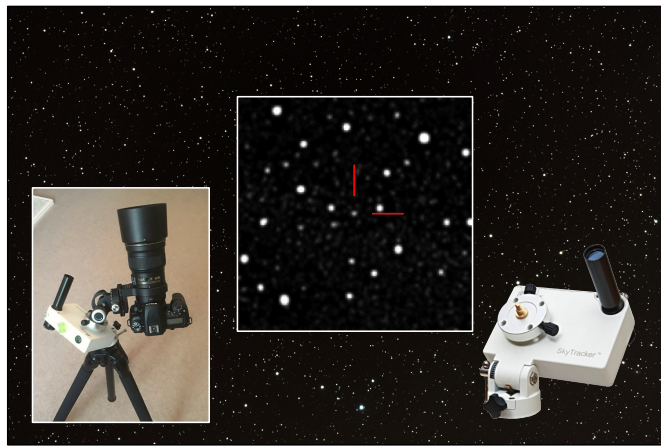
Markarian's Chain



Nikon D7500 / 300mm lens / 240 x 20s

38

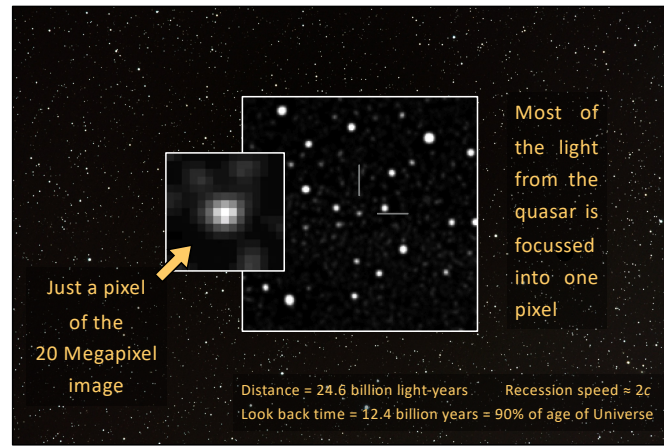
Lockdown Challenge



Nikon D7500 / 300mm lens / 256 x 30s

39

Lockdown Challenge



Nikon D7500 / 300mm lens / 256 x 30s

40

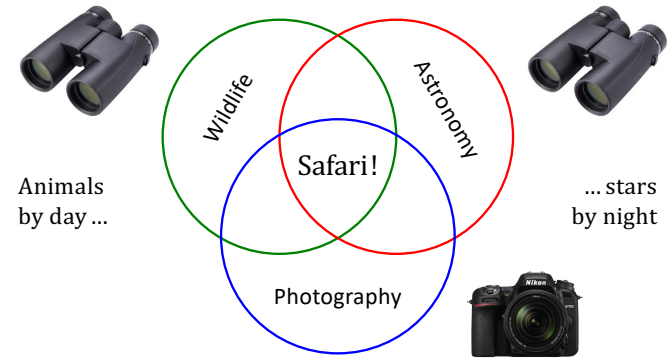


# Astrophotography

## What Do You Need?

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## Wild Astronomy



( Sleep when you get home )

## Aligning Using Polaris

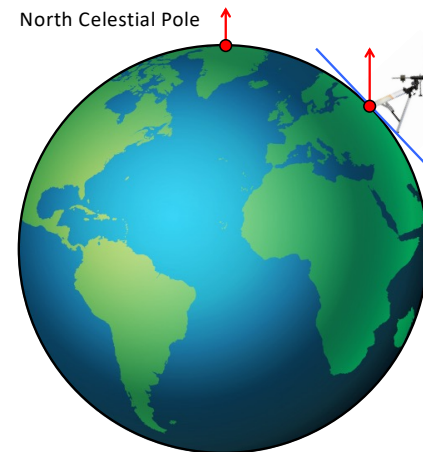
With Polaris visible, aligning a star tracker is easy in the UK.



But ...



## Aligning a Star Tracker



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

# Astrophotography

