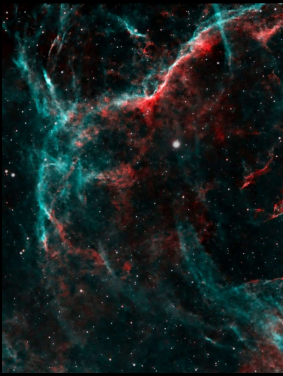# Slide 1

Beginners Astrophotography
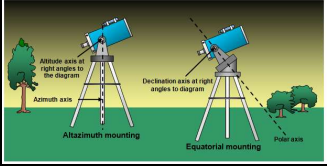
Gary Liney

Week 3: Mounts, Star-trackers and Guiding

1

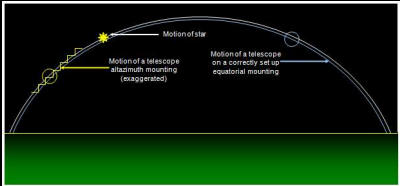# Slide 2

Mounts

- Altitude-Azimuth (AltAz) mounts
- Equatorial (EQ) Mounts

2

Slide 3

AltAz Mounts

✓ Easy to use
- Cannot match star motion
- Star bloating
- Field rotation

3

Slide 4
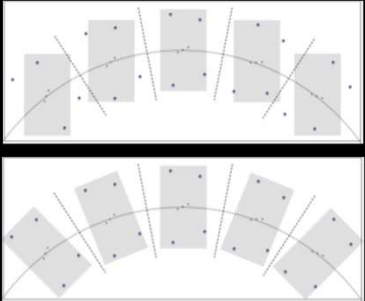
My First Image: AltAz Tripod

Bloated stars and obvious background noise

4

Slide 5

Field Rotation

- AltAz can only track a point
- Over time the rest of the frame rotates
- Reduces the stacked image FOV

5

Slide 6

EQ v AltAz

- Overlay of image taken with EQ and AltAz mode of star tracker
- Stars get bigger and more misaligned further from tracked centre

6

EQ Mounts

- EQ wedge is used
- Set angle to correct local latitude
- Turns Az into RA, Alt into Dec

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Example Mounts

- Star trackers are portable for dark sky sites
- Heavy mounts very stable with more precise guiding
- Can get head and mount combined/seperate
- Payload will dictate the scope that can be used and exposure length

	Sky-Watcher Star…	Saxon EQ5 GoTo…	Sky-Watcher EQ6-R Pro…
	$1,049.00 Bintel	$1,495.00 Astronomy …	$3,055.00 Bintel ★★★★★ (72)
Weight (kg)	2.5	15	35
Payload (kg)	5	11	20

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Equipment: Star Trackers

➢Other examples

Built in wedge

Weight & shaft

Built in polarscope

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Equipment Level: Star Tracker

➢Skywatcher AzGTi
Intended for AltAz only
Cost about $600
Can now get packages with scopes
Can be modified to operate in EQ mode

Firmware upgrade (free)

Upgraded saddle ($80)

EQ wedge ($110)

1kg counterweights ($60 ea)

Threaded bolt ($5)

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Polar Alignment (PA)

- Need to align the RA (polar) axis to the south or north celestial pole
- Errors in this alignment show themselves up as mis-shapen stars
- Accuracy depends on FL in use
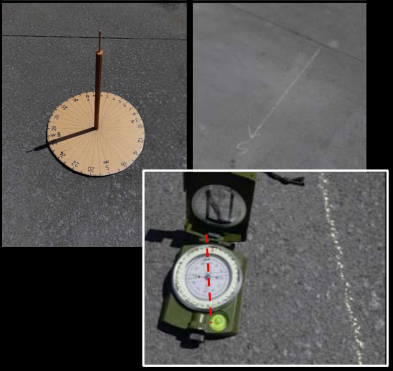- PA within 1 arc min is good enough for most set-ups

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PA Methods

- Rough alignment with compass/sun or some other
- Visual alignment with polarscope
- EAA methods
- Drift alignment
  ✓Much longer but very accurate
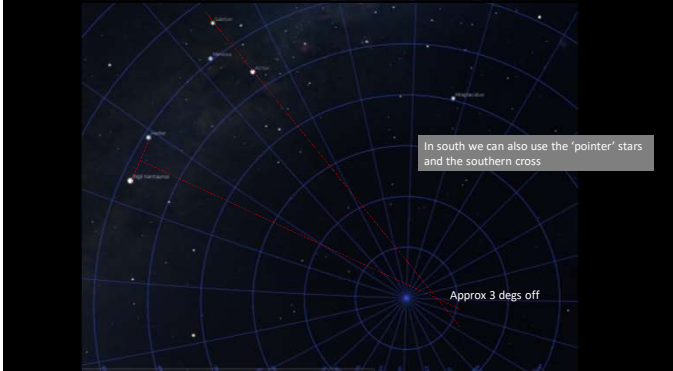 ✓This method does not require CP to be visible!

Improving accuracy

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Finding SCP

- Use known position of sun and home made sun dial to find N-S
- And/or use compass
- Phone compass App also works
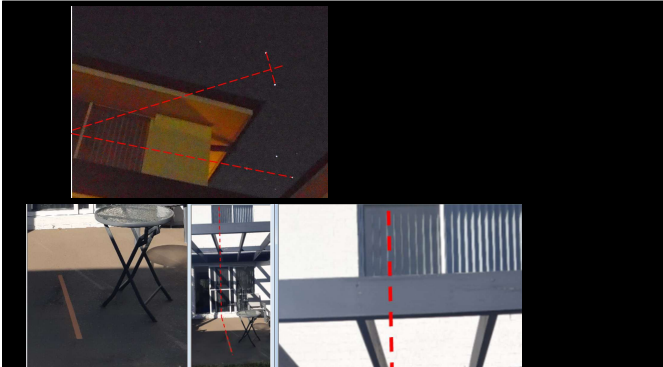- This is a good starting point for other methods

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In south we can also use the 'pointer' stars and the southern cross

Approx 3 degs off

14

15

Good enough?

- No view of Mars from usual spot
- Could not see SCP
- PA by phone compass app
- 50 mm with 10 s exposures for 15 min
- Two separate days to show planet movement
- Not best quality (kit lens) but no trails
- Final result shown in Week 5

Mars 8/1/23

Mars 30/12/22

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Polarscope

- More accurate- requires sighting of poles
- Scope that projects star template
- Move mount to align stars
- In south we use the Octans trapezium
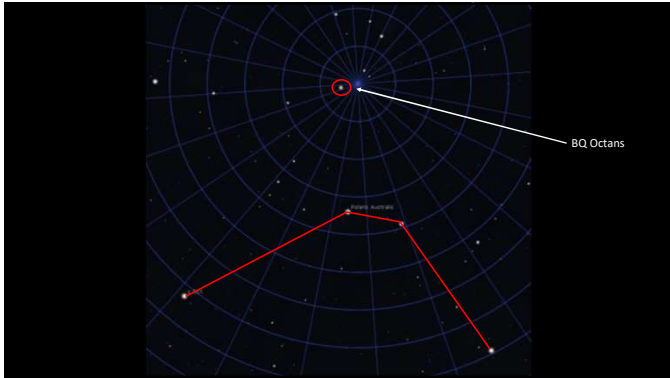

Sky Watcher PT6C Polar...
$69.10
AliExpress.c...

PoleMaster by QHY...
$495.00
Astronomy ...

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In this Stellarium view we can see Octans

18

BQ Octans

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- This is how I used to do PA
- Take image from my camera (battery!)
- Try and get the circled star as close to centre of FOV
- The image on right has been plat solved to show SCP

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EAA Example

- Sharpcap Pro upgrade (small annual fee approx. $20)
- Uses plate solving
- Requires user to rotate mount 90 degrees
- Very quick and accurate
- Need to already be within 5 deg of CP
- Need camera finderscope set-up

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- Determines whether or not close enough

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Adjustments

altitude adjustment knob

For initial large left-right movements (>1 degree) move the whole tripod

Azimuth adjustment screws

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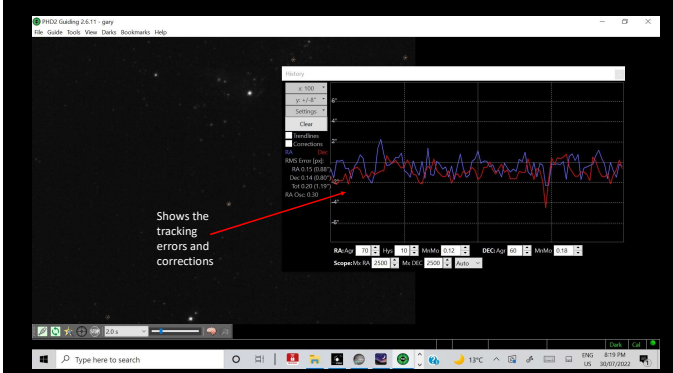This should be at least 'Good'

Adjust by this amount

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Guiding

- Even with PA the tracking will have errors
- Use of a separate camera to monitor a star in FOV
- Sends small adjustment to the mount to correct tracking errors
- Popular application is ''PHD2''
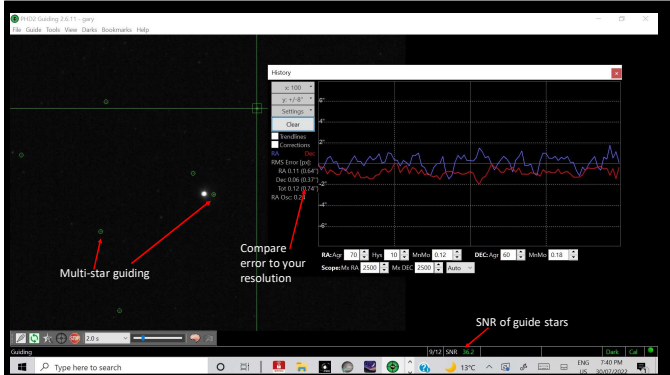- Can get subs of many minutes!

Main imaging camera

Guidescope & camera

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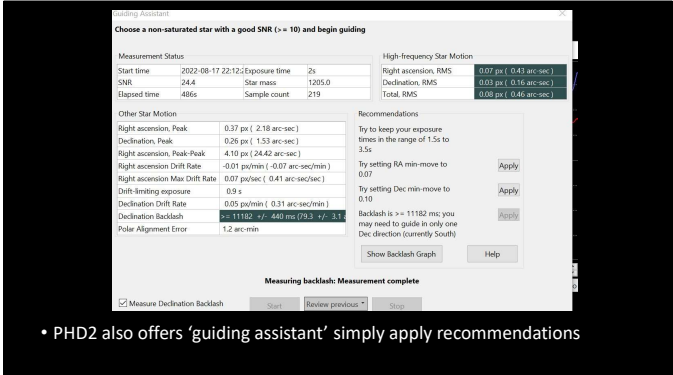Shows the tracking errors and corrections

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Multi-star guiding

Compare error to your resolution

SNR of guide stars

27

- PHD2 also offers 'guiding assistant' simply apply recommendations

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Guided vs Unguided

6 min subs at 135 mm

1 min & 3 min subs at 360 mm

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Dithering

- Fixed pattern noise on sensor
- Stacking subs means same pixels on sensor added
- Can be reduced by 'dithering'
- Deliberate movement of sensor every so many frames
- Can be done manually or automatically
- Some use this instead of dark calibration; I tend to use darks only

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Goto Mounts (Star Alignment)

- Some star trackers only 'track' earth's rotation
- Others have built in 'Go to' capability like expensive mounts
- Locating invisible targets can become tedious (impossible!) without this
- To get this to work need to perform star alignment

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Goto Mounts (Star Alignment)

- Make sure location is set properly (long/Lat)
- Select 1 to 3 bright stars- usually a choice is provided based on best calculation
  - 3 star alignment will give best results and is necessary for targets that cannot be easily located or longer FL
- Centre each one in turn using camera
- This becomes tonight's 'pointing model'
- Can save and restore later if tripod is not moved
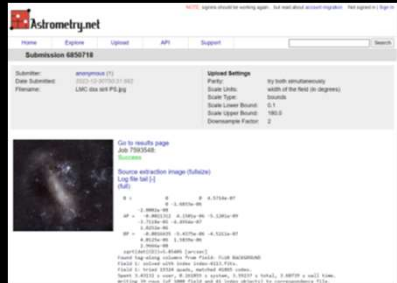- Thereafter any target can be located

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Plate Solving

- Matches image to known star atlas
- Can be done online (Astrometry.net)
- Can be done on laptop with saved index files at correct FOV
- Can also be done in live acquisition software
- This helps determine accurately where the mount is
  - For some targets you may not 'see' them even when centred so this becomes vital

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Plate Solving

- Using Astrometry.net
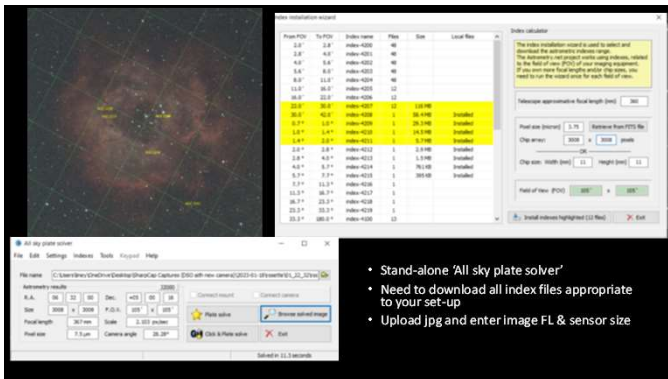- Upload any jpg
- No other info needed

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Plate Solving

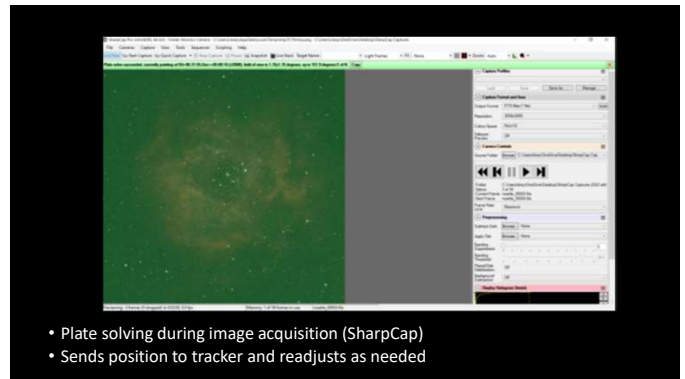- Produces co-ordinates
- Resolution
- Labels all known DSO

35

36

37

- Stand-alone 'All sky plate solver'
- Need to download all index files appropriate to your set-up
- Upload jpg and enter image FL & sensor size

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- Plate solving during image acquisition (SharpCap)
- Sends position to tracker and readjusts as needed

The Upshot...this is what I use

- 135 mm (fast) lens
1 min in dark sky or when using NB filter in LP

- 360 mm (slower) scope
4 min guided when using duoband filter in LP
20-30s for everything else

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Summary

- You can use AltAz tripod and stack lots of short subs- but you will be limited in quality & brightest targets
- Star trackers are most economical per image quality
- Go to functionality is also recommended to make life easier
- Heavier/longer FL imaging will require sturdier mounts with exceptional tracking ($$$$)

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Questions?

www.austrophtography.com

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