Occultations from a Beginner's Perspective

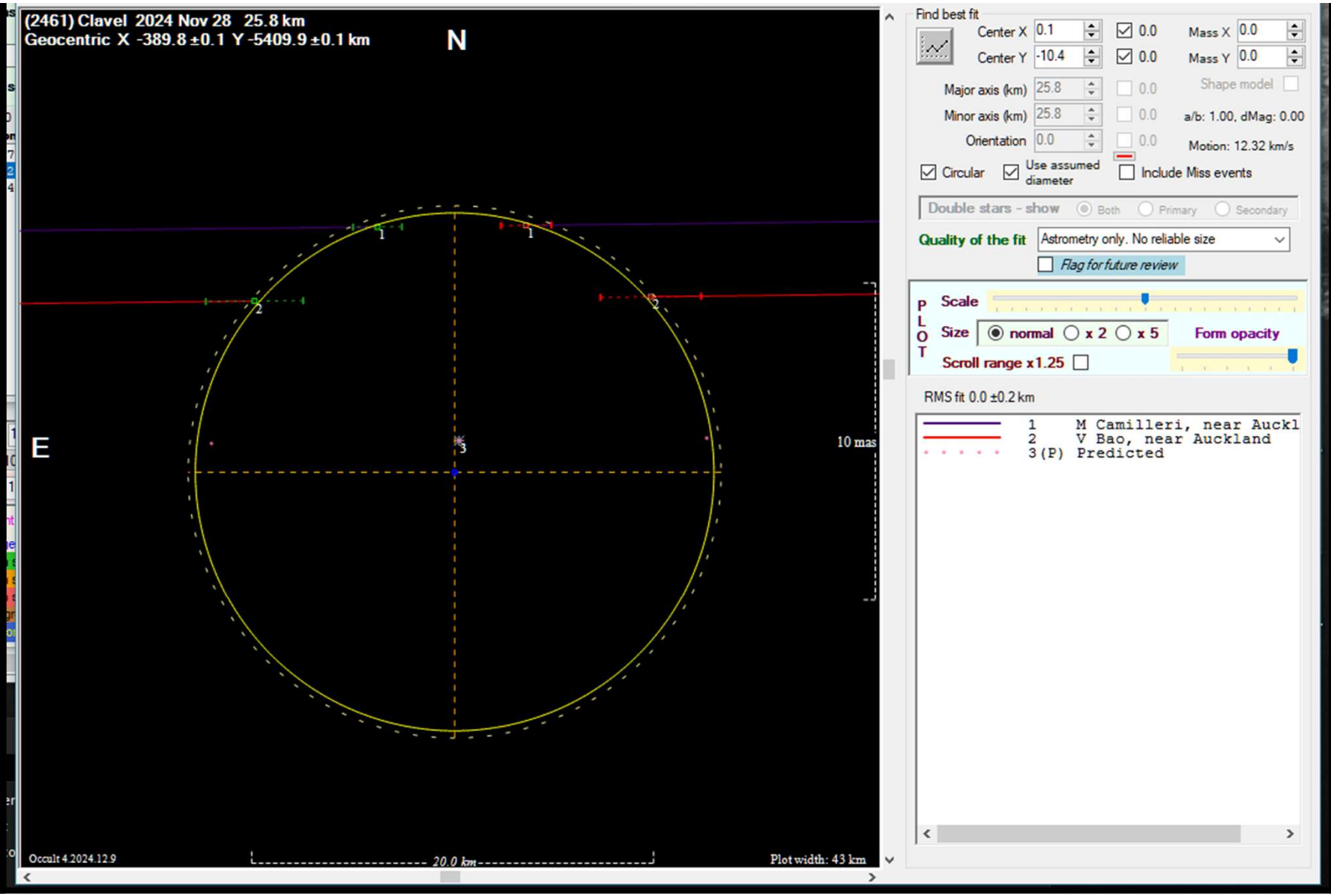
Victor Bao

About me

- University student
- Astronomy is a recent hobby, I bought my first telescope Dec 2022
- Observed my first occultation (a positive) on Nov 28 2024
- Reported 17 observations, 6 positive

Why occultations?

- Real science from my own backyard
- Quick
- Can be easy
- Interesting

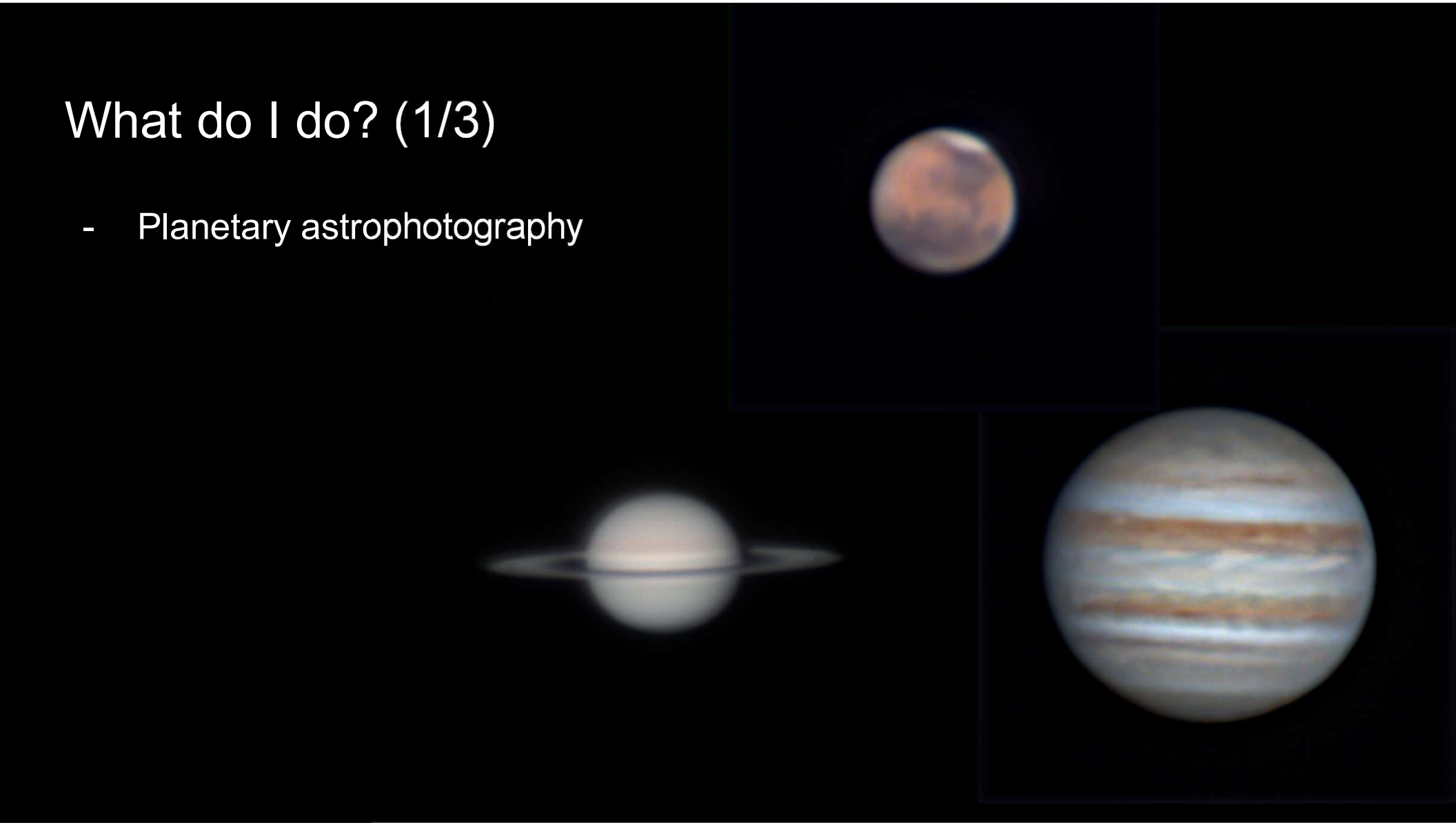

(2461) Clavel 2024 Nov 28 25.8 km
Geocentric X -389.8 ±0.1 Y -5409.9 ±0.1 km
N
E
10 mas
20.0 km
Occult 4.2024.12.9
Plot width: 43 km
Find best fit
Center X 0.1
Center Y -10.4
Mass X 0.0
Mass Y 0.0
Major axis (km) 25.8
Minor axis (km) 25.8
Orientation 0.0
Shape model
a/b: 1.00, dMag: 0.00
Motion: 12.32 km/s
Circular
Use assumed diameter
Include Miss events
Double stars - show
Both
Primary
Secondary
Quality of the fit
Astrometry only. No reliable size
Flag for future review
PLOT
Scale
Size
normal
x 2
x 5
Form opacity
Scroll range x1.25
RMS fit 0.0 ±0.2 km
1 M Camilleri, near Auckl
2 V Bao, near Auckland
3(P) Predicted

What did I start with?

- Sky-Watcher EQM-35 Pro mount
- GSO 200mm f/4 Newtonian
- ZWO ASI224MC
- Astrophotography/EAA with modest equipment

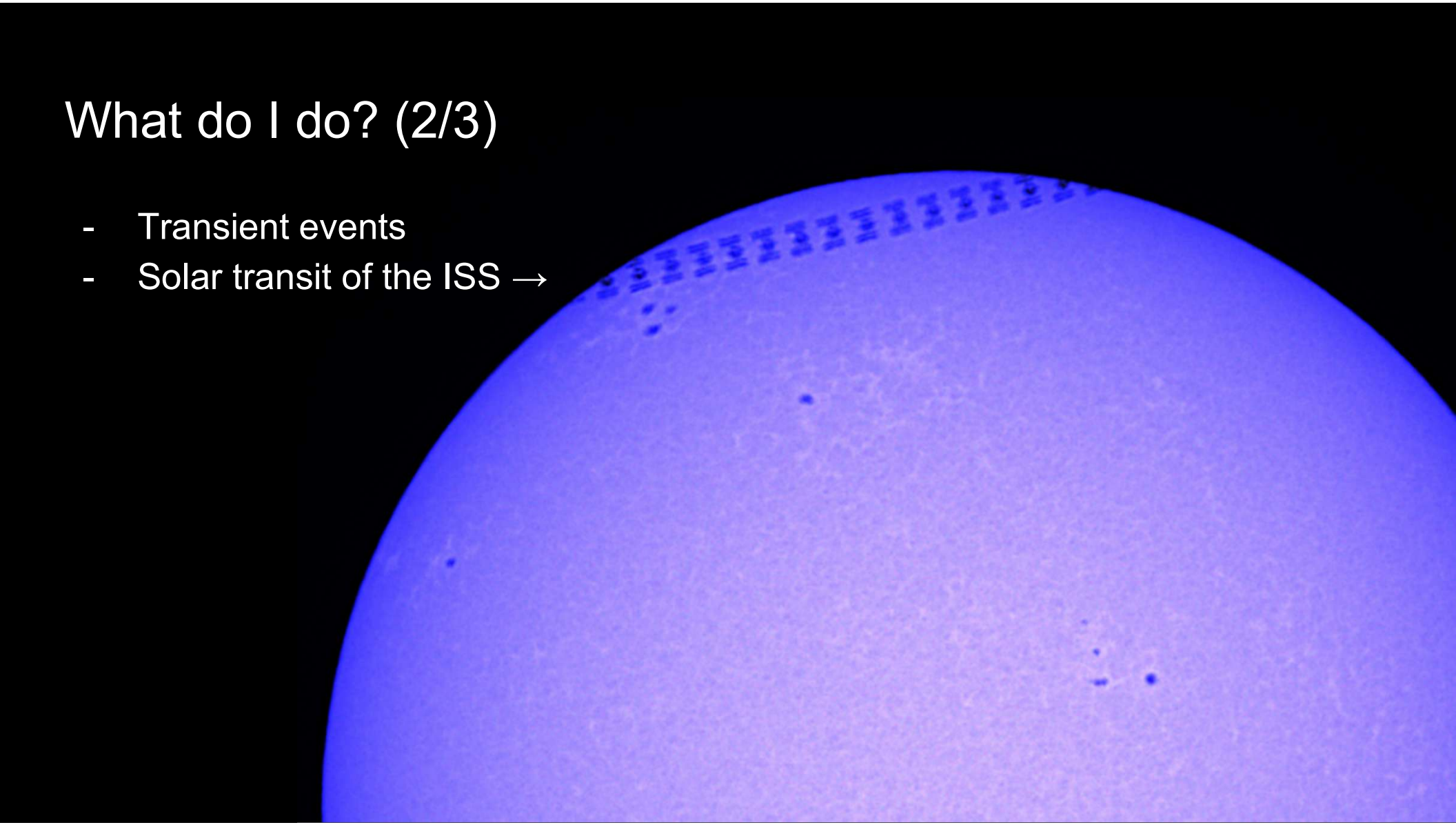
What do I do? (1/3)

- Planetary astrophotography



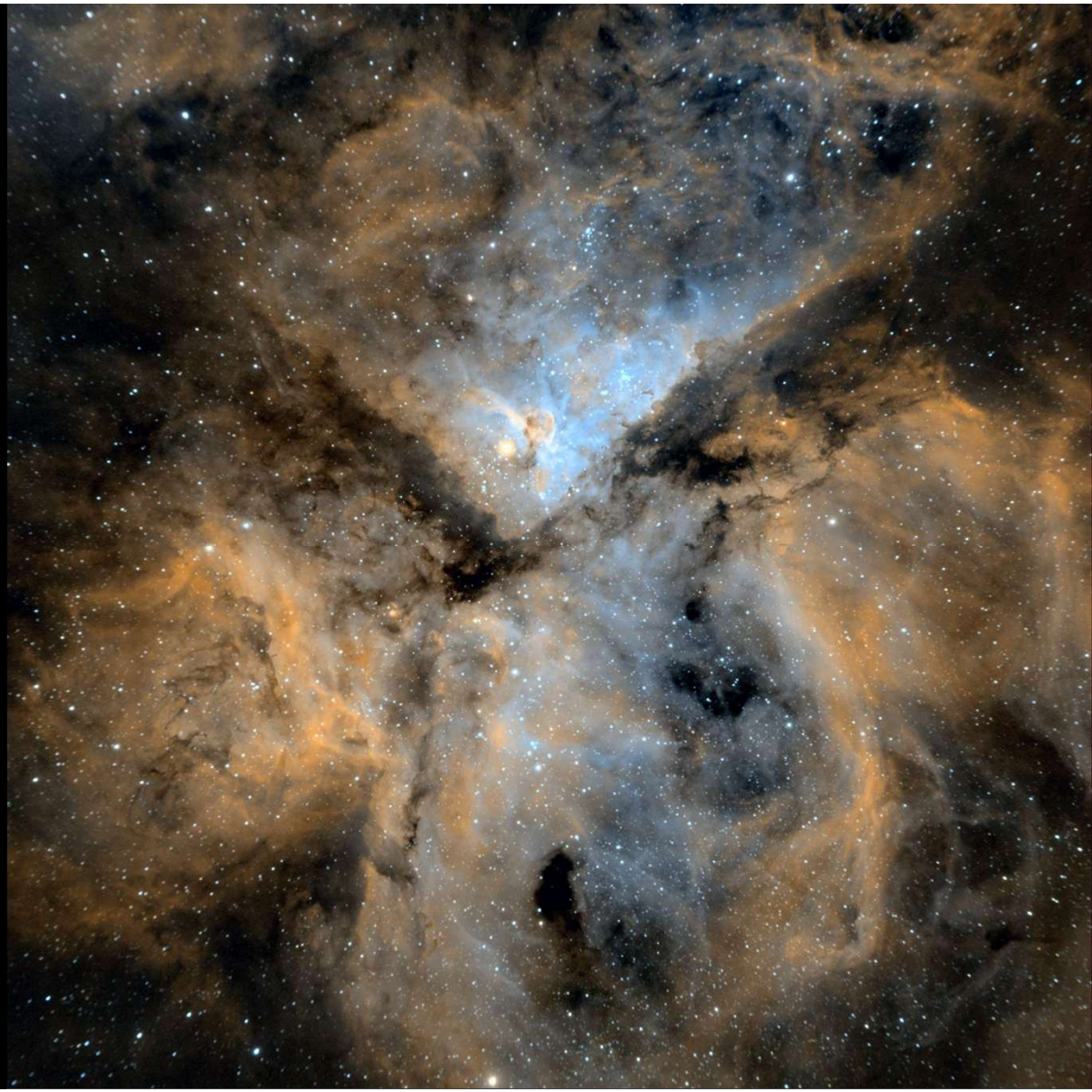
What do I do? (2/3)

- Transient events
- Solar transit of the ISS →



What do I do? (3/3)

- Occasional deep-sky astrophotography



Upgrades for Occultations

- Player One Ceres 462M ($169 USD)
- USB GPS flasher (~$5 USD)
- SharpCap Pro (~$20 USD)
- SOFTWARE: Occult 4, Occult Watcher, OWC, Tangra, Meinberg NTP
- Training

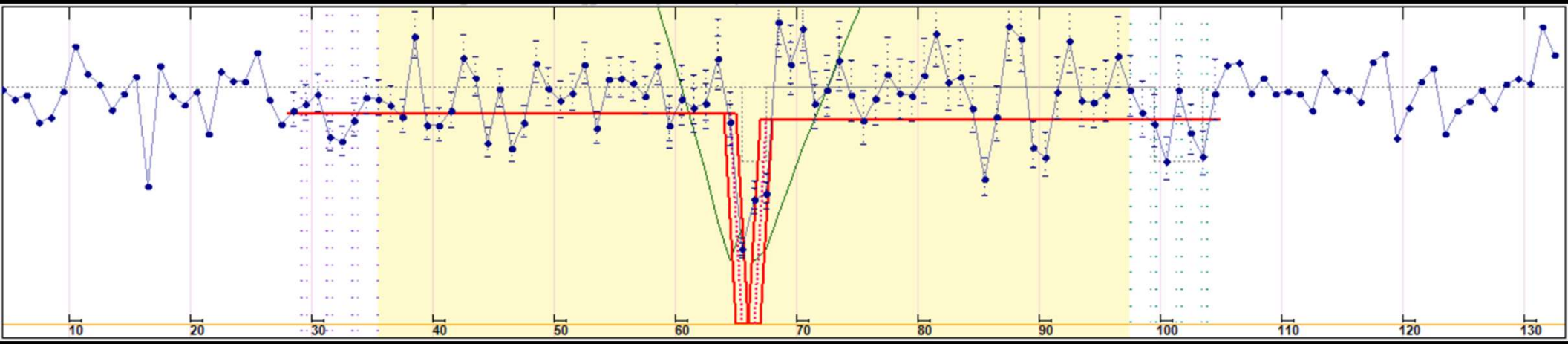
Current Occultations Workflow

1. Set up all equipment in the backyard
2. Polar align with SharpCap
3. Plate solve to correct star field & identify target star
4. Correct camera settings: exposure/gain, 2x bin, .ADV/.SER, timestamps, ROI
5. Record with GPS flashes before & after 3-sigma time uncertainties
6. Process photometry in Tangra
7. Calculate delays (NTP offset + camera acquisition) from GPS flashes
8. Apply time delays to photometry
9. Process in AOTA for D/R times
10. Report!

My thoughts

The fun parts

The hard parts



- Learnt how to plate solve, polar align
- New sensitive mono camera → more imaging opportunities

Difficulties from a Beginner's Perspective

- Barrier for beginners is having the time, know-how and equipment
- My equipment worked ok
- Time is scarce as a tired student… weekends only
- Know-how was hard to come by without guidance, initially unable to find relevant documentation for timing digital CMOS data and photometry processing/reporting
- Huge thank you to Michael Camilleri for all the help
- Could be useful to create updated documentation for all steps from acquisition to reporting for beginners?


Thank you!
Lunar Occultation of Saturn, 28 June 2024
Victor Bao