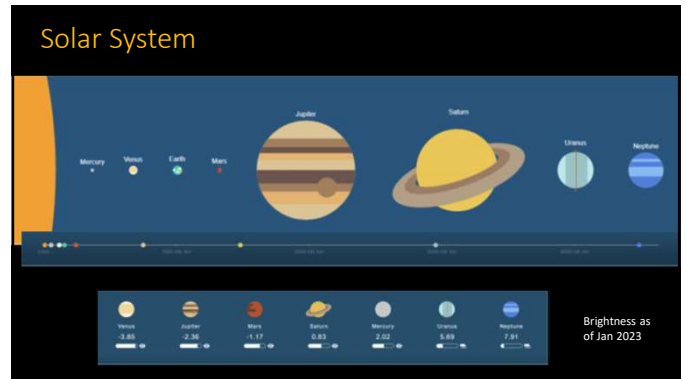
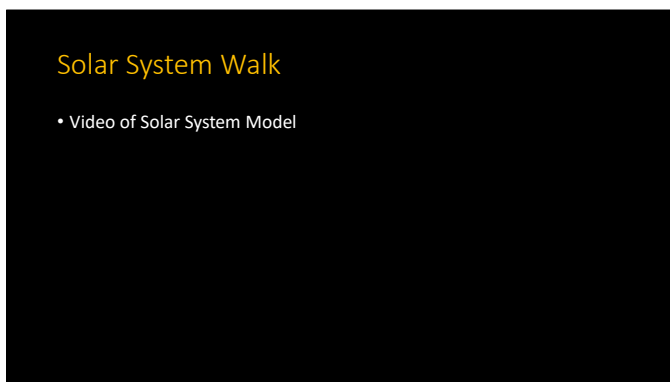


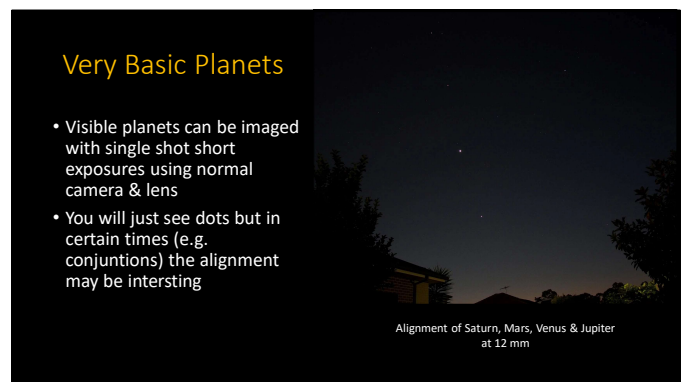
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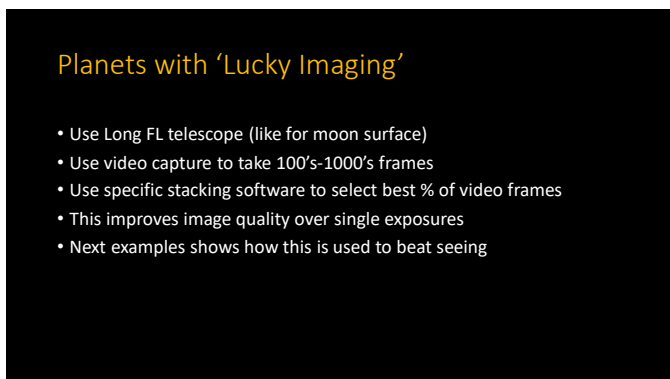
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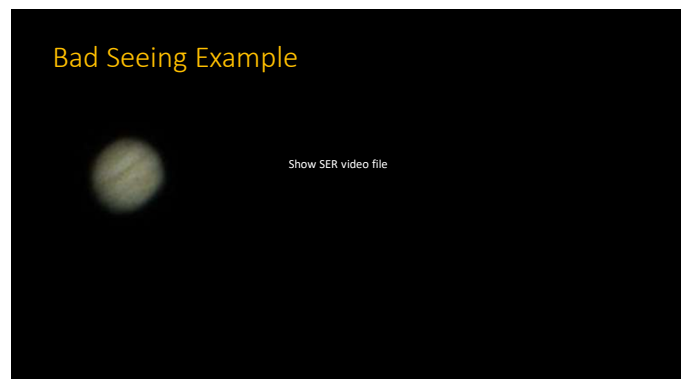
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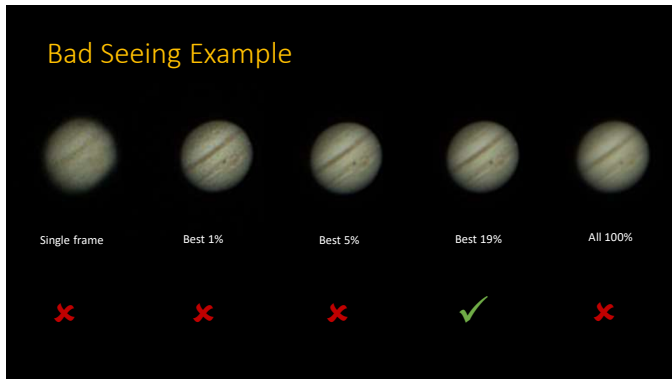
4



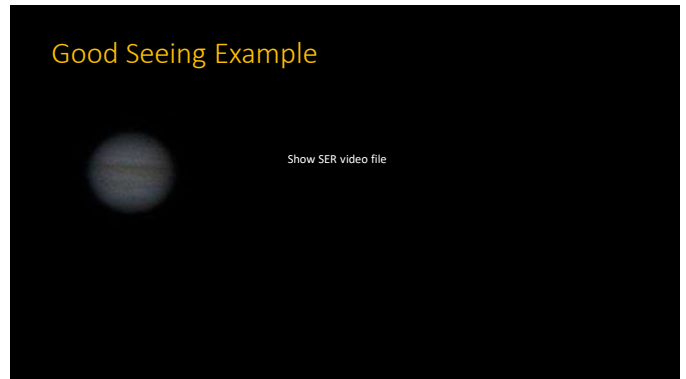
5



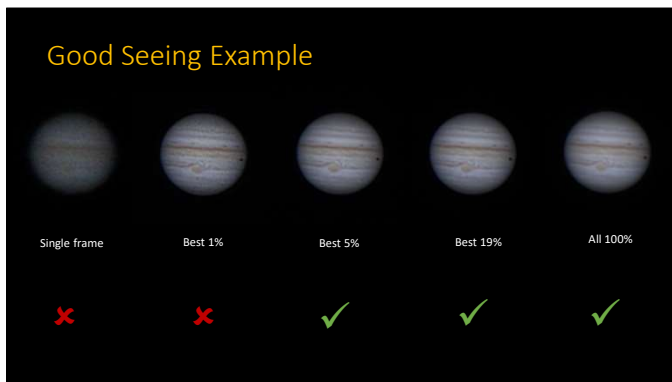
6



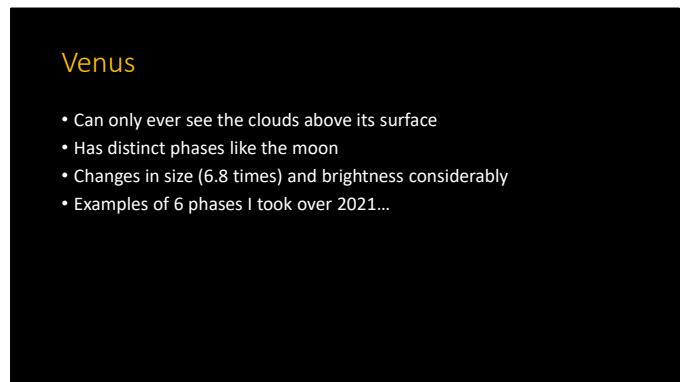
7



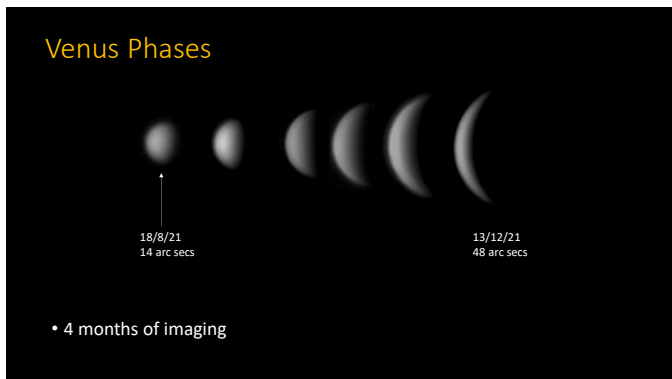
8



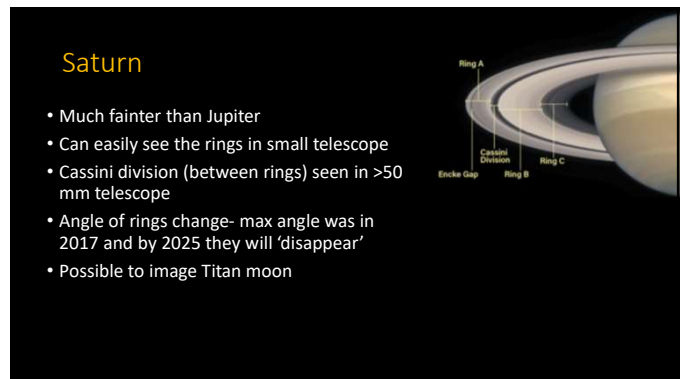
9



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11



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## Saturn

- Very difficult to find as it is so faint
- Use of Flip Mirror on fixed tripod
- Allows imaging and visual
- Started using this before I got a star tracker

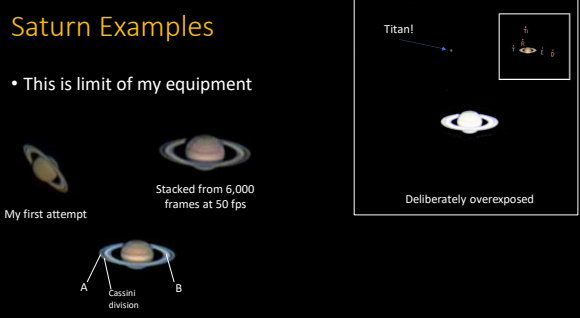


Video of Saturn moving

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## Saturn Examples

- This is limit of my equipment



Cassini division

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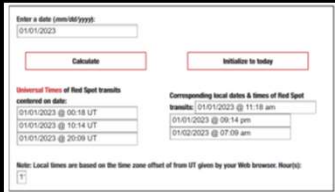
## Jupiter

- Most interesting planet
- Lots of surface detail
- Red spot transition takes about 100 mins
- Four Galilean moons can be observed
- Transits of these moons and red spot make good animations

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## Red Spot Transit

- <https://skyandtelescope.org/observing/interactive-sky-watching-tools/transit-times-of-jupiters-great-red-spot/>



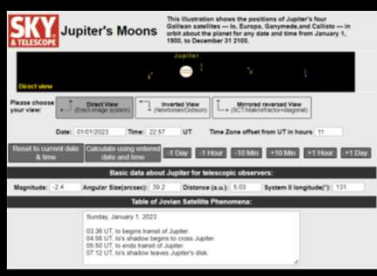
Universal Times of Red Spot transits centered on date:	Corresponding local dates & times of Red Spot transits:
01/01/2023 @ 00:18 UT	01/01/2023 @ 11:18 am
01/01/2023 @ 10:14 UT	01/01/2023 @ 09:14 pm
01/01/2023 @ 20:08 UT	01/02/2023 @ 07:08 am

Note: Local times are based on the time zone offset of from UT given by your Web browser. (Hour(s))

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## Jupiter's Moons

[https://skyandtelescope.org/wp-content/plugins/observing-tools/jupiter\\_moons/jupiter.html](https://skyandtelescope.org/wp-content/plugins/observing-tools/jupiter_moons/jupiter.html)




**Table of Jovian Satellite Phenomena:**

Event	Time (UT)
Sunday, January 1, 2023	
03:26 UT to begin transit of Jupiter	
04:58 UT to end shadow begins to cross Jupiter	
05:52 UT to end transit of Jupiter	
07:12 UT to end shadow leaves Jupiter's disk	

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## Galilean Moons

8/11/22, 23:48 PM



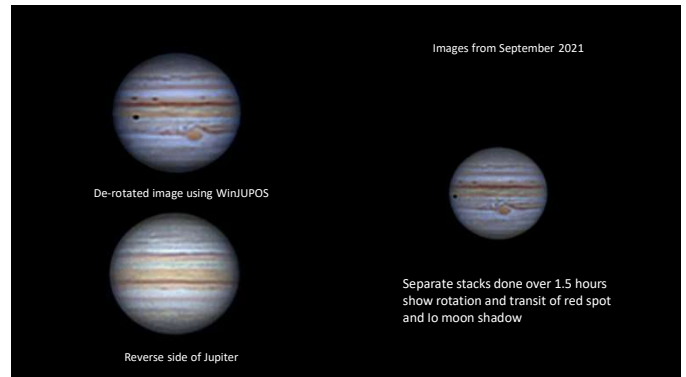
Example images of Jupiter and its moons

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## WinJUPOS

- Extra (free) software
- Has rotation period of 9.9 hours
- Acquisition time should be limited to prevent blurring  
(I have seen internet advice vary from 45s to 3 mins!)
- Using WinJUPOS it is possible to combine multiple acquisitions over long periods and correct for rotation
- This maximises SNR

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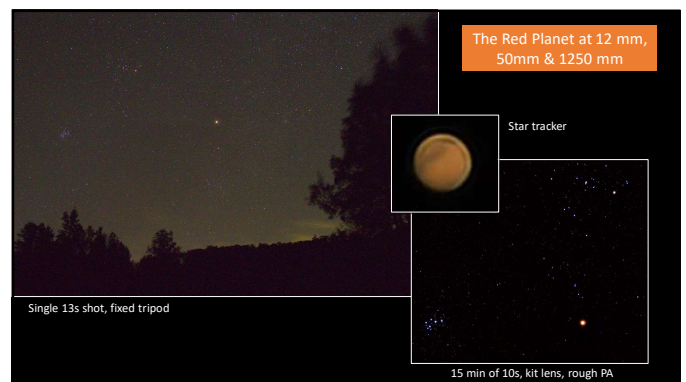


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## Other Planets

- Mars
  - Another planet that changes size x7
  - Ice caps and volcanoes..(sort of) with 90 mm scope
- Mercury
  - similarly to Venus it exhibits phases
  - Next planet solar transit is mercury...in 2032!
- Uranus
  - Not managed to capture this yet!
- Neptune
  - Managed to capture this but basically tiny dot with my scope

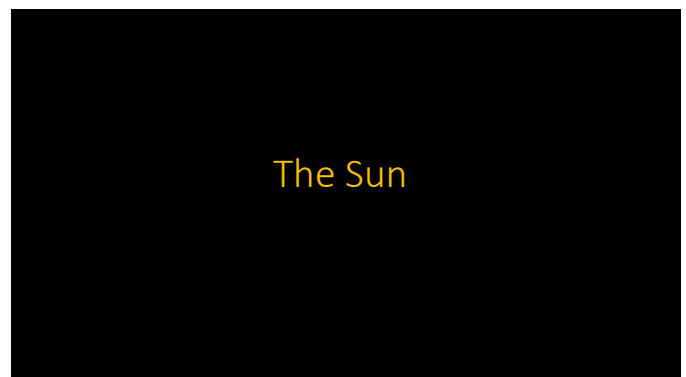
21



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23



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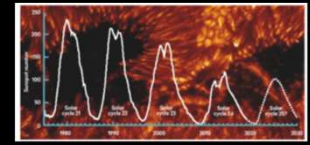
## The Sun

- Appears same size as moon
- Requires solar filter but otherwise can be imaged with same equipment & techniques
- White light filter reduces intensity by 99.9%
- Sun spots are easily seen with single or video captures
- For other solar features a dedicated (very expensive) solar telescope is required

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## Solar Cycle

- Solar cycle every 11 years
- Changes as magnetic pole flips
- Next predicted maximum is 2024
- Overall sunspot activity has been decreasing



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## Useful Websites

- Solar activity  
<https://www.spaceweatherlive.com/en/solar-activity/sunspot-regions.html>
- Time and date
- 'Seeing' website-now relevant in daytime

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## Solar Filter

- Special film that block 99.9% light
- REMOVE finderscope
- Use shadow or telescope or some other indirect way to align
- You can use same imaging techniques as you would with the moon
- Same processing software



My solar filter with homemade lens hood

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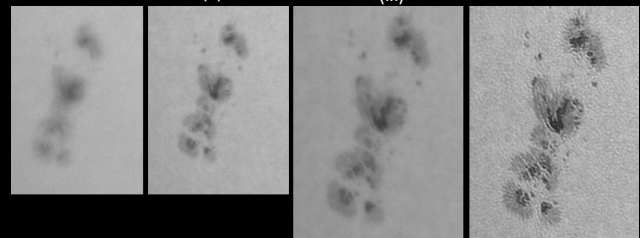
## Solar Filter



Finding Sun can be tricky- be careful what you use &amp; DO NOT USE YOUR FAVOURITE EYE!!!

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(i) (ii) (iii) (iv)



80 fps taken over 20s with a (i) bad and (ii) good frame shown, (iii) the stack of best 13% and (iv) final post-processed with wavelets

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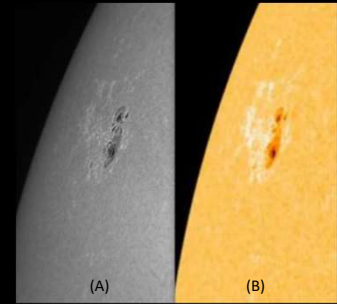
## Sun Spots

- Sun spots are slightly cooler temperature due to magnetic field
- Units of MH (millionths of a hemisphere)
- >300 MH is considered big
- Largest recorded was 6,000 MH
- Earth is approx. 169 MH



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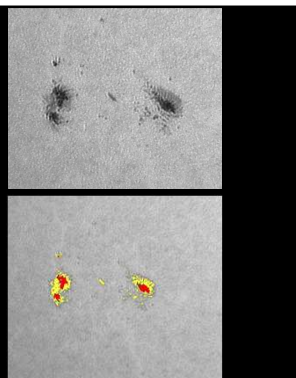
(A) AR2859 on 22/8/21 taken from backyard.  
(B) Spaceweather website image, listed as 80 MH size



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## Changes

- (right) AR2860 170 MH
- Captured over 5 days (below)
- Grew to 330 MH and changed its magnetic class from beta to beat-gamma



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## Other Fun in the Sun

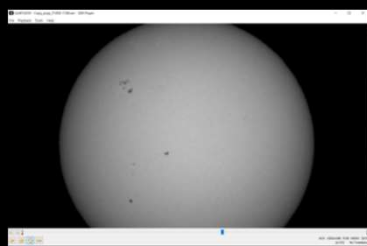
- Total and annular eclipses
  - Time and Date also shows upcoming eclipses
  - Next one is April 2023 (we will get partial eclipse in Sydney)
- ISS Transit
  - Same website as shown in Moon lecture
  - I have managed this once...

20 Apr 2023 at 2:28 pm	Global Event: Total Solar Eclipse
	Local Type: Partial Solar Eclipse, in Sydney
Max View in Sydney	Begin: Thu, 20 Apr 2023 at 1:56 pm
	Maximum: Thu, 20 Apr 2023 at 2:28 pm 0.191 Magnitude
	Ends: Thu, 20 Apr 2023 at 3:18 pm
	Duration: 1 hour, 42 minutes

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## ISS Transit

- MFT camera in video mode
- 30 fps
- Set my watch according to internet time
- Start record just prior to expected transit
- Whole thing took 0.7 s



Show Video

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## Summary

- Sun can be treated as a daytime moon in terms of how you image it
  - YOU NEED A FILTER PLEASE DO NOT ATTEMPT WITHOUT ONE!!
- The bright visible planets are relatively easy but unlike moon and sun you really will benefit from bigger telescope

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