ASTR2013 Field Trip Worksheet Solutions

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Siding Spring Observatory

1. When Siding Spring observatory was established in 1962 on Mt Woorat/Siding Spring mountain, what were three key parameters that made this a good site?

Low cloud cover, low background light and a stable atmosphere.

2. Now that the Chilean sites are well developed with better astronomical seeing and also have low water vapour, what are some reasons that SSO remains a competitive observatory on the world stage?

When the sun rises in Chile, it is setting at Siding Spring, meaning that it is a great observatory to follow-up transient discoveries made in Chile. The observatory also has excellent instrumentation, especially for multi-object spectroscopy (i.e. 2dF, which is unique in the Southern Hemisphere).

3. Roughly how many telescopes in active use are there at Siding Spring observatory? Which part of the mountain are most of them located?

There are approximately 40 telescopes.
Most of them are located within the iTelescope roll off roof building.

The ANU 2.3m telescope

4. The 2.3m telescope is also called the advanced technology telescope, partly because of the relatively inexpensive rotating building. How does the building rotate with the telescope without vibrating the telescope mount?

The building and telescope have completely separate mounts. When the telescope rotates, the building senses where the telescope is follows its motion.

5. Who can you call from the 2.3m in an emergency? (3 numbers)

For anything life-threatening, 000. Additionally, the AAT night assistant +61 2 6842 6279 or the emergency mobile 0429 685 288. [I'll accept other answers as well, as some information was not quite up to date]

6. Where is the first aid kit?

Next to entry door (bottom of staircase). Also in control room.

7. What is the emergency evacuation route from the control room?

Down the back stairs - door at the opposite side of control room to entry door.

8. The 2.3m telescope has roughly the same primary mirror diameter as Hubble. For visible light observations, Hubble is more sensitive to detecting faint stars. Why?

Star images are smaller, so sees less background (zodiacal light).

9. What type of observations could have the same signal to noise for either Hubble or the ANU 2.3m? (neglecting find details of instrument sensitivity)

Visible light observations of 'blurry' objects like galaxies that are larger than the seeing disk, or observations (e.g. spectroscopy) of objects that are brighter than the sky in a $\sim$2" aperture.

10. There are 3 focal stations of the 2.3m telescope. What are they, which two are in use and why do you think the unused focal station is unused?

Nasmyth A, Nasmyth B and Cassegrain. The Cassegrain station is unused because it has more difficult access and is not gravity-stable (i.e. it tilts).

The Anglo Australia Telescope

11. What instruments are now in the Coudé rooms of the AAT? Why is the Coudé mirror train no longer used?

The AAOmega and Veloce spectrographs. Fibers are used instead of the set of Coudé mirrors to get the light to these rooms.

12. What are the two "top ends" that are now generally used at the AAT?

The 2dF top and and the f/8 Cassegrain top-end.

13. The AAT mount is equatorial. What were two reasons that this mount was chosen rather than an altitude-azimuth mount?

No image rotator is needed, and no computers were needed to determine the telescope pointing.

14. If you wanted to measure the coronal activity in the Calcium H and K lines at 393 and 397 nm of many stars in a cluster of diameter 0.5 degrees, which AAT instrument would you use? Why?

You would use the 2dF top end, in order to get many spectra at once. For a spectrograph, you would use AAOmega because can detect light at those wavelengths.

15. The AAT was originally designed for imaging. What is the primary mirror shape and what was this optimised for?

The primary mirror is hyperbolic (almost parabolic). This was optimised for imaging over the full field of view at the f/8 Cassegrain focus.

16. The AAT is no longer competitive for imaging. Why?

For wide field of view imaging, the $A\Omega$ product is higher for other telescopes (and even the UKST was equal to the AAT). For imaging requiring find detail, Hubble is much better as it has no atmospheric turbulence.

SkyMapper Telescope

17. The SkyMapper telescope is a wide field imaging telescope designed for two key science cases. What are they?

Detecting transients (i.e. supernovae) and metal poor stars.

18. The SkyMapper telescope's full operational capability was significantly delayed, and it still doesn't meet full original specifications. What was the primary cause of its initial problems?

Vibrations transmitted through the telescope, originating from the cryoocoolers.

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OOPS - QUESTION DOUBLED UP.

20. SkyMapper's main competitor in the northern hemisphere is now the Zwicky Transient Factory. ZTF is a 47 square degree camera on a telescope very similar to the UKST. Measuring performance simply by $A\Omega$, the product of telescope area and solid angle, how much 'better' is ZTF than SkyMapper?

ZTF has an $A\Omega$ product that is 57 square degrees $\times$ square m, compared to 8.2 square degrees $\times$ square m for Skymapper. This means it is 7 times 'better' bu that metric..

Las Cumbres Observatory

21. The LCO telescopes are part of a global network. What types of observations have they been most useful for?

Follow-up of transient sources (also exoplanet transits).

UK Schmidt Telescope

22. The UK Schmidt telescope has a very wide field of view. What are two disadvantages of the telescope design for wide field imaging?

1) Focal plane is curved, and 2) Focal plan is difficult to get to.

23. The RAVE survey was a highly successful recent use of the UKST. What did it measure and what property of the UKST enabled the survey?

It measured spectra of hundreds of thousands of stars. These spectra produced radial velocities via redshift/blueshift (as well as stellar paramters). The wide field of view of the UKST enabled this "all-sky" survey.

The Parkes Radio Telescope

24. The Parkes Radio telescope was built before the AAT, yet uses an altitude-azimuth mount. How was this controlled accurately before the days of computers?

The telescope was guided by a 'master equatorial' mount located inside the dish (at the intersection of the altitude and azimuth axes).

25. Rather than pixels, radio telescopes have feeds that typically record electric fields rather than power. Parkes has created beautiful images, especially of HI gas. What is the maximum number of simultaneous effective pixels that Parkes can use to create an image? How many effective pixels does the fancy new ultra wideband receiver have?

The Multi-Beam receiver has 13 effective pixels. The ultra-wideband receiver has only 1.

26. How smooth is the central white part of the Parkes dish? What determines this requirement?

The central white part of the disk is smooth to better than 0.5 mm. This is determined by the need to accurately reflect radio waves at 50 GHz frequencies (i.e. a wavelength of $\sim$7 mm).