Aaron Roodman – Lecture 2 Questions

Questions marked in green were answered during the Q&A session. No attempt was made to correct grammar/spelling issues. Where a slide number was given it is shown.

Q1 (slide 3): Just so that we can get a better comparison, what was the "state-of-the-art" before the Vera Rubin Observatory?

I'd say the Dark Energy Survey. Comparing capabilities (Rubin,DES): Etendue (340,40). Observing Time (3650 nights, 550), Sky coverage (20k sqdeg, 5k), Projected mean PSF size (0.7",0.95"), Observations of each part of sky (825, 50).

Q2 (slide 5): Just out of curiosity: how difficult was it to fund a telescope with only 1 instrument and 1 goal? I've never heard of a telescope with such a focus before.

There are others, but they are all much smaller. The first proposal for something like the Rubin observatory was made by Tony Tyson in 1998. Federal funding (650M$) was secured in 2012.

Q3 (slide 6): What do the red lines stand for?

The ecliptic and the Milky Way

Q4 (slide 7): Does the telescope only take images in one band at a time?

Yes, the filters cover the full field of view.

Q5: Why do you need to tile the sky with only one band at a time in the movie?

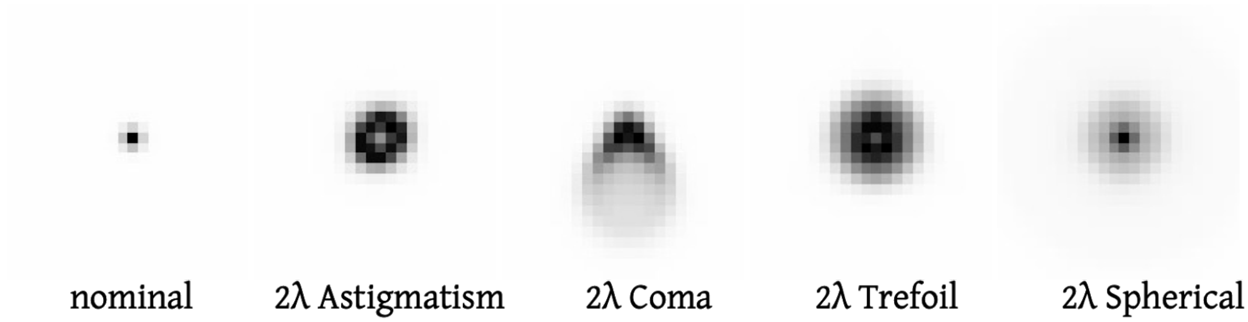
see Q4

Q6: How are the observing bands decided for Rubin ?

The wavelength bands should be about 100-150 nm wide, and we've designed them to overlap. The nomenclature and approx wavelength values are similar to those from the SDSS

Q7: What's coma? (On the optical system slide, mentioned as a common aberration that we want to reduce)

Here is what a point source (a star) looks like with (exaggerated) amounts of the primary aberrations. Coma is called that because it looked like a comet to 18th century astronomers



Q8 (slide 12): Why is the slewing (?) faster when the telescope and primary mirror are the same size?

Its not that the slewing itself is faster, its that the telescope and camera can return to stability (<0.05 arcsec jitter) in a shorter period of time with a squat design. A longer telescope structure will vibrate longer.

Q9 (slide 12): Does this mean that in each picture, there's a hole in the field of view?

No. There is a hole in the *pupil* (ie. its an annulus defined by the primary mirror), but the field of view corresponds to the range of *angles* that the light coming into the telescope makes with respect to the optical axis. And that range of angles is fully covered.

Q10: What's involved in calibrating an amplifier?

Finding the bias (digital level corresponding to no light), the gain (conversion between digital level and number of electrons in the CCD) and nonlinearity (in the electrons to digital level conversion). Calibration images of various sorts are taken to determine these.

Q11 (slide 22): What are the units (on the bar to the right) of the image of the woodcut?

Counts - ie. digital value in the ADC.

Q12: How does changing the CCD thickness impact the wavelength of the light that you can detect?

The absorption length in Si is highly wavelength dependent, ranging from ~micron at 350nm to ~100 micron at 1000nm. Our CCDs are 100micron thick, so we have good sensitivity up to around 1000nm, important for detecting light from redshifted galaxies

Q13 (slide 23): Overall, how much of the construction was done by external companies?

For the Camera, the CCDs were made by 2 companies (Teledyne-e2v and ITL) and the lenses and filters were made by several different companies - all completely custom made. Otherwise, most everything from the electronics to the mechanical structures were made by the the LSST Camera team. For the telescope: the mirrors were made by the Steward Mirror lab (primary/tertiary) and industry for the secondary, the telescope mount was designed by LSST and built and constructed by a company, other components were similar: designed in house and built by industry.

Q14 (slide 24): Sorry--what do w_a and w_0 mean again?

parameters in a model where:

$w = w_0 + w_a * (1-a)$

Q15: Why does the Hubble constant decrease before increasing in the hubble DESI diagram.

Remember the Hubble ratio is a parameter, dependent on the composition of the Universe for its variation over cosmic time. That plot has z increase to the right, so looking backward in time. As the mix of DM and DE change in the Universe, the Hubble parameter changes too.