Aaron Roodman Lecture-1 Questions

Questions marked in green were answered during the Q&A session. Original questions mostly listed without correction for grammar/spelling. Where a slide number was given it is shown.

Q1 [slide 3] When you say homogeneous, do you mean perfectly homogeneous, nearly perfect, or homogeneous only on certain length scales?

We assume DE is perfectly homogeneous

Q2 [slide 4] What does oCDM stand for?

A model with DE having exactly w=-1

Q3 [slide 5] Wouldn't a modification to GR necessarily be a quantum field (that is, shouldn't GR itself normally be eventually describable by a quantum field)?

No not necessarily, modifications to GR may be entirely classical. Merging GR and QM is a different issue.

Q4 [slide 5] Is dark energy a new kind form of matter, distinct from the field, wave and particles?

As a vacuum energy, DE could be a field. From what we understand, it is not a new form of matter or a particle.

Q5 [slide 6] What about strong lensing power spectra?

Systems with strong gravitational lensing present, when the source and lens are extremely well aligned, are fascinating and beautiful, with much to teach us about cosmology and astrophysics. For instance, multiply lensed quasars, with time variability offer a new way to measure the Hubble parameter. Unfortunately these systems are quite rare, such that we will be unlikely to be able to measure power spectrum

Q6 [slide 8] I'm afraid I missed it -- why do we adjust the higher end of this spectrum to be linear?

On this figure it is for illustration. The data has been corrected for the difference expected between NL and Linear Power spectra.

Q7 [slide 8] What is the significance of this spectrum being smooth?

Sharp spectral features are easier to detect and measure, and a smooth spectra is more of an experimental challenge.

Q8 [slide 9] In which case does convergence is negative, what a kind of matter configuration in the lens that gives this result ?

Lensing around a DM void can produce negative convergence, or demagnification.

Q9 When measuring shape of lensed galaxies, does it depend on they are face-on or edge-on or with some angle?

Yes, the shape will depend on this orientation, but note that the weak lensing shear is, to 1st order, additive with the intrinsic galaxy shape.

Q10 [slide 14] what are the redshifts of the nicer-looking galaxies in the wide field picture, and the redshifts of the blurry-dot-looking galaxies in the zoomed-in picture?

The galaxies whose spiral structure you can see are generally within z<0.1 or even 0.2, in ground-based images.

Q11 [slide 10] To assume galaxies are randomly oriented, one must know the distribution of different shape of galaxies. Then the question is, how do people know the distribution of unlensed shape of galaxies?

We can infer the distribution of the ellipticity, but what matters most is that for random orientation, the mean of the ellipticity without lensing is zero.

Q12 Would a weak lensing telescope in space be eventually achievable? Or is it generally better to do it from the ground.

Yes, both Euclid and Roman telescopes aim to study weak lensing from space. Advantages from space are much better images are possible without atmospheric turbulence, no absorption of light in the atmosphere, images into the infrared can be taken much more effectively without water absorption. Disadvantages are >x10 in cost and complexity in space compared to an equivalent telescope on the ground, risk of failure in launch or operation, limited data bandwidth to ground, etc. In practice, Euclid is a much smaller telescope, with smaller field of view, fewer bands, and significant compromises (eg. pixel scale) to stay within a certain cost cap. For example, Euclid needs LSST photometric redshifts. Roman is more ambitious. There are also collaborative efforts between projects to maximize our scientific output.

Q13,17 What are the overall wavelength and redshift ranges at which the DES (and other weak lensing telescopes) take measurements in?

350-1000 nm and z up to 1.5 for most galaxies (Quasars can be seen to z~6)

Q14 [slide 17] How were the redshifts of the "known" galaxies previously obtained?

Using the “red sequence” and taking advantage of the much better photometric redshift of these galaxies.

Q15 [16-17] While measuring Photometric redshifts, how is the Balmer line of Hyderogen identified without using spectroscopy?

It isn’t really identified, but the flux measurements in the different bands are quite sensitive to the location of the turn on of the Balmer lines.

Q16 [slide 17] What was meant by "we only need the width of the distribution"--if I caught that correctly?

It turns out that the detailed shape of the redshift in each tomographic bin isn’t critical to determine. The mean and width of the distribution is enough, systematically.

Q18 Can we obtain weak lensing data from images obtained from the Hubble space telescope? And in the future from the James Webb telescope?

Yes, and Hubble has been used for some weak lensing work. Obviously it provides superb images, free from atmospheric distortions. However, the field of view of Hubble is quite small, and observing time is precious, so only a small portion of the sky has been imaged for WL - too small to do measurements of the cosmic shear and power spectra. Many galaxy clusters have been observed with Hubble, and WL is used to measure the mass of those clusters.