ROUND-TABLE AND POST-MEETING NOTES (complied by Alistair Walker)

1. New Surveys with DECam

At the end of calendar 2018, observations for the DES and DECaLS will be completed. The DES alone occupied ~105 nights in the B semesters 2013-2017 and 50 in 2018B, while DECals started in 2014A and is scheduled for ~70 nights in 2018A+B. From these two surveys in excess of ~125 nights per year become freed-up. Therefore there will be a call for new survey proposals, with the announcement being made in June 2018, a letter of intent due by ~August 2018, and full proposals to be submitted by September 30 2018. Details will be in the announcement, however it is not the intent to lock in an excessive number of large surveys with several-year observing span, but rather to keep flexibility and so one can anticipate that there would be future survey announcements, probably at yearly intervals.

Specifically mentioned surveys in the course of discussions and presentations include -

(i) a complete u band survey over the whole southern sky, this should if at all possible match the CFIS-u survey about to start on the CFHT, which covers 10000 sq. deg of the sky N of Dec 0, to u(AB) = 23.6 at S/N = 10. To reach this depth takes DECam 500 seconds in a dark sky with 1.3 arcsec images, thus a survey of the same area is a ~60 night project.

(ii) to fill in the SMASH survey around the MC with SMASH II. SMASH covered 480 sq. deg of 2400 sq. deg, with 57 nights awarded, in u,g,r,I,z, so a filled survey in all filters to the same depth would take ~ 200 nights.

(iii) Solar system moving object survey (from Arjun Dey) 120 second exposures would cover 1000 sq deg per night, so 20,000 deg (S of DEC +30 deg) in 20 nights. Repeat. Use the VR filter so reach VR(AB) ~ 24.

(iv) Variability/transient surveys. Many of these are underway already –e.g. Jeff Cooke, Abi Saha.

2. Filters

DECam presently has the quasi-SDSS u,g,r,i,z filters plus Y, VR, N964 (9 nm) and N662 (18 nm). This totals nine, given there are eight filter positions so from time to time we need to swap filters. This is likely to be a swap of N662 with N964. N964. Operationally, it is easier to change filters on the west side compared to the east side (telescope pointing to the north). A filter change is a careful ~2 hour procedure, it is not zero risk so we do not want to get into changing filters on a fast cadence.

Presentations and discussions suggested some other filters to add to the above complement:

(i) Jorge Casares would like a narrow Hα (4 nm) plus a wide Hα (20 nm) both centered at 656.3 nm, and a third even broader filter "quasi-r" also centered on Hα, with the primary science being the discovery of stellar BHs.

(ii) Zhenya Zheng pointed out that given the success of N964 other

wavelengths could be targeted by similar NB filters

(iii) Several people mentioned that for for stellar science filters that could provided metallicity information are very useful, and also the need to separate dwarfs and giants at magnitudes fainter than the Gaia limits. (Hughes et al MNRAS, 939, 788, 2014 is a useful reference). A DDO51 filter (515/16) for giant/dwarf (mid G to late K) separation, and a Washington C (400/50) that is sensitive to CN/CH and thus a proxy for metallicity (with caveats), perhaps also or instead a CaH+K filter.

(iv) Also mentioned were filters for [OIII] 5007 nm, and maybe other emission lines, and also

(v) some filters for helping with LSST photo-z's, e.g. filters that bracket the LSST filters.

3. Possible Imaging Synergies with LSST

From the Tom Matheson presentation:

- parallel observing: with different filters
- precede: short time baseline, with VR filter for solar system objects
- follow: multiple filters, to get SED
- alternate cadences

Here are two sketches of science cases, as examples:

Science Case One: Help to discover and characterize LSST transients.

Task: LSST is expected to discover an enormous rate of transient events in quasi real time and, especially in the first ~two years, the majority will be new. Initially these will be moving objects, variable stars, variable quasars, SNe, true transients – those defined as reaching a brightness change rate of 1 mag/hour (Z. Ivezic definition), at a rate of up to 10000 per minute. After ~two years, new discoveries will be dominated by cataclysmic variable stars and quasars. Before that, by solar system objects, for < 30 deg from ecliptic, variable stars will dominate in the galactic plane but still ~400 per field even at the galactic pole, supernova (100 per field), quasars (100-500 per field). An event broker such as ANTARES will classify the events. Some – the true transients - will need rapid follow up, both to aid in the characterization, and to obtain as many measurements as possible.

Mode proposed: Consider the Blanco/DECam pointing at the same position as the LSST, it would need to know in advance because it cannot move so fast. 2-3 minutes would be enough. The LSST takes its 2x15s exposures in some filter, then moves on. The Blanco takes its first exposure simultaneously (30s) in some (other) filter, then continues taking a series of exposures at the same position - different filters, the same filter, or some combination. Then after 5-10 minutes it is done. It then moves to where the LSST is about to take another exposure, and repeats. So the duty cycle is such that the Blanco covers ~2% of the LSST area per night and is not going so deep, but that rate still corresponds to many tens of thousands of events per night. The event rate could be a lot less and this mode would still be valuable.

Ideally, the Blanco images should also be processed rapidly, differenced, and the results are fed into an event broker that is also handling the LSST stream.

We need synchronization between telescopes. The TCS's need to talk to each other. Some of these concepts are being initially tested with Las Cumbres and SOAR..

Science Case Two: Following up LSST discovery of stellar over-densities and streams. The Crater II dwarf galaxy, at ~ one degree diameter and very low surface brightness, is a perfect example. Deep targeted exposures in multiple filters.

Task: LSST will not be very deep at least in the early years. 450 seconds per year per field. Three times the collecting area of Blanco. Blanco can go as deep or deeper than the LSST after 10 years with ~7 hours of integration per filter.

Mode proposed: Deep, targeted exposures with DECam of the fields of interest, with multiple filters. The LSST and DECam exposures will identify targets for spectroscopy with 6-8m telescopes.

4. Likely community science priorities for DECam data processing in the next 10 years

From Adam Bolton's summary of the DECam data splinter meeting –

(i) Support for crowded fields
(ii) Support for difference imaging
(iii) Support for management of data-analysis workflows
(iv) Support for multiple calibration methods
(v) Support for flexible, scalable processing (and reprocessing) – different applications want different processing cadence, - PI science wants raid turnaround a la Community Pipeline, - Different calibration choices for PI vs. survey science
(vi) Support for application of LSST software to DECam