LSST and Other Big Surveys: Joint Processing, Analysis, and Optimization

LSST Observing Strategy Workshop

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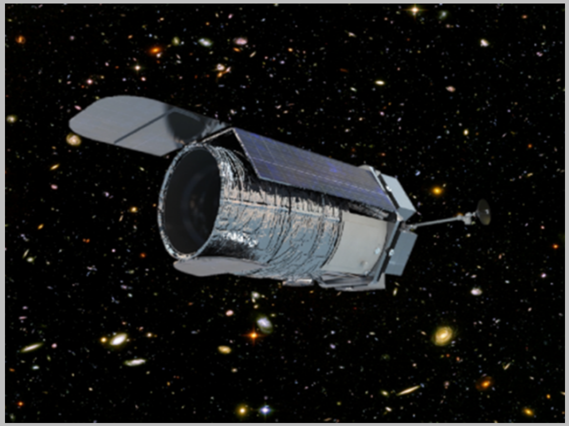
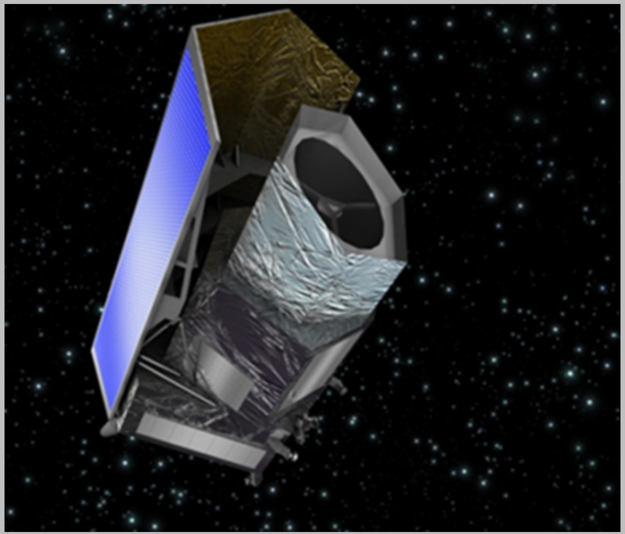
Bremerton August 20, 2015





The Whole is Greater than the Sum of the Parts: Optimizing the Joint Science Return from LSST, Euclid and WFIRST

February 21, 2015

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Imaging Survey Comparison

	LSST	WFIRST	Euclid
Start	*2022 (2020)*	*~2024*	*2021*
Area	*18,000*	*2,300**	*15,000*
Location	*~south*	*Overlap LSST*	*Best*
Time	*10 years*	*2 of 6 years*	*6 years*
Passes	*Many*	*~5*	*1*
Depth	*25-28 optical*	*27 NIR*	*24.5 optical*
Bands	*ugrizy*	*4 NIR*	*1 wide optical,*
Spectra	*No*	*Grism & IFU*	*Grism*

* Could be much larger in an extended mission or using GO time

Calibrating Photo-zs

- Secure and complete samples of spectra down to the weak lensing limit will be required to calibrate photo-zs
- Naïve, brute-force estimates indicate 100,000 spectra needed
- Clever algorithms can get this down to a few 10^4
- The hard part is completeness at faint magnitudes
- Euclid and WFIRST will have grisms that get tens of millions of spectra over entire survey area
- WFIRST will have an IFU that could get 10^4 spectra down to LSST depth in normal parallel operations

Take Away Message: WFIRST and Euclid can help, but not solve, LSST photo-z calibration

Photo-zs

Every weak lensing galaxy requires a photo-z!

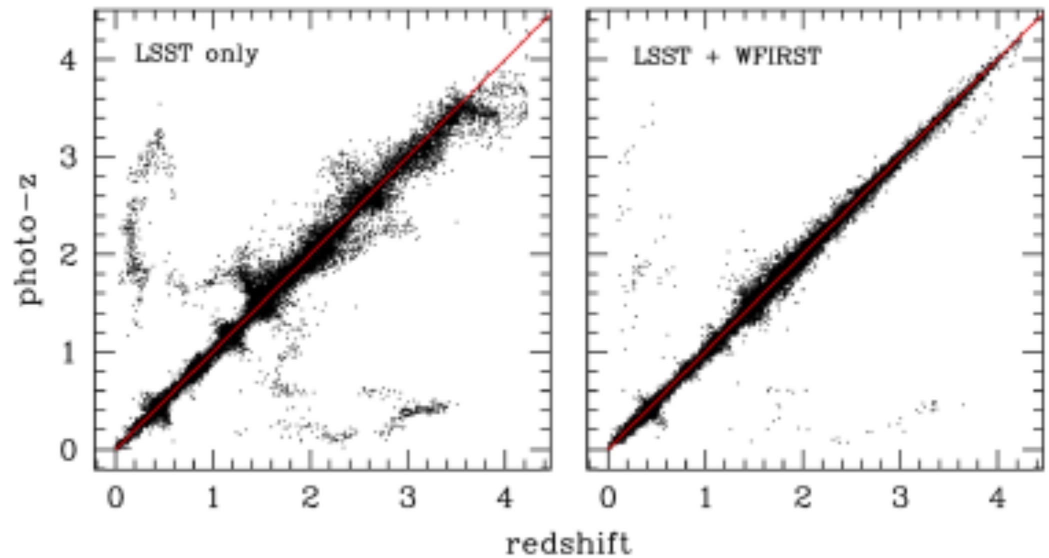

Figure 2: A comparison of the relative photometric redshift performance of the LSST optical filters (left panel) with a combination of LSST and WFIRST filters (right panel). The simulated data assumes a 10-year LSST survey and a "gold sample" with $i < 25.3$. The addition of high signal-to-noise infrared data from WFIRST reduces the scatter in the photometric redshifts by roughly a factor of two (at redshifts $z > 1.5$) and the number of catastrophic outliers by a factor of three. These simulations do not account for deblending errors or photometric calibration uncertainties, and assume complete knowledge of the underlying spectral energy distributions of galaxies as an ensemble.

Euclid Cadence Coordination

- LSST will reach the depth required for Euclid photo-z very quickly
- Euclid is single-pass, so will cover its survey area 2,500 square degrees per year
- There is no wide field cadence coordination needed
- Deep fields could be coordinated (let’s wait)

Primary coordination in survey planning is **overlap area.** How can we maximize Euclid/LSST overlap? Many constraints on both, but overlap is mutually beneficial.

WFIRST Cadence Coordination

- WFIRST requires full LSST depth to achieve required photo-z accuracy
- WFIRST wide survey (High Latitude Survey/HLS) will thus overlap completely with LSST (deep fields likely in both hemispheres)
- LSST will benefit greatly in photo-z and systematics mitigation in overlap area

Primary coordination in survey planning is **achieving full depth early in WFIRST HLS.** Early probably means the first ~4 years of LSST operations.

WFIRST/LSST Coordination