Subaru Measurements of Images and Redshifts (SuMiRe) and the Large Synoptic Survey Telescope (LSST)

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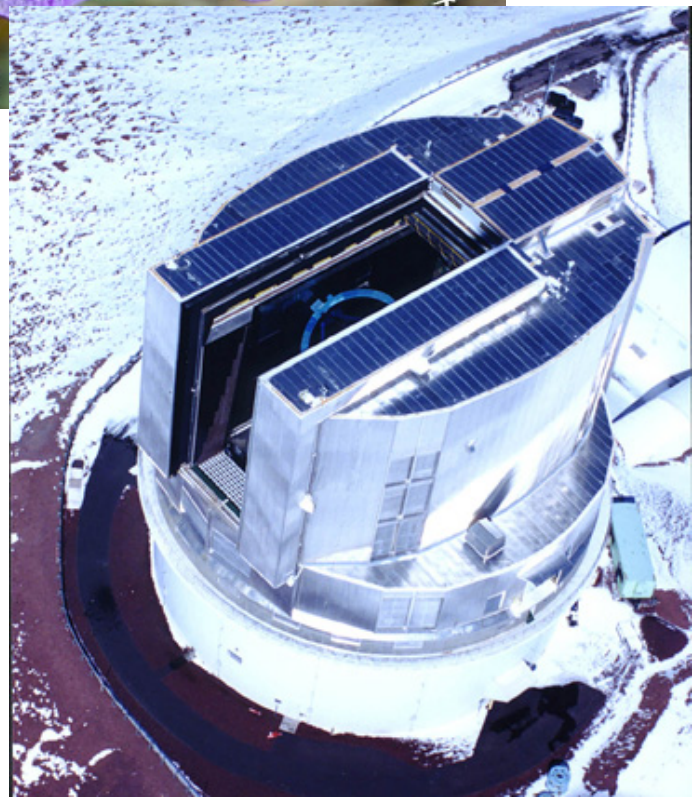
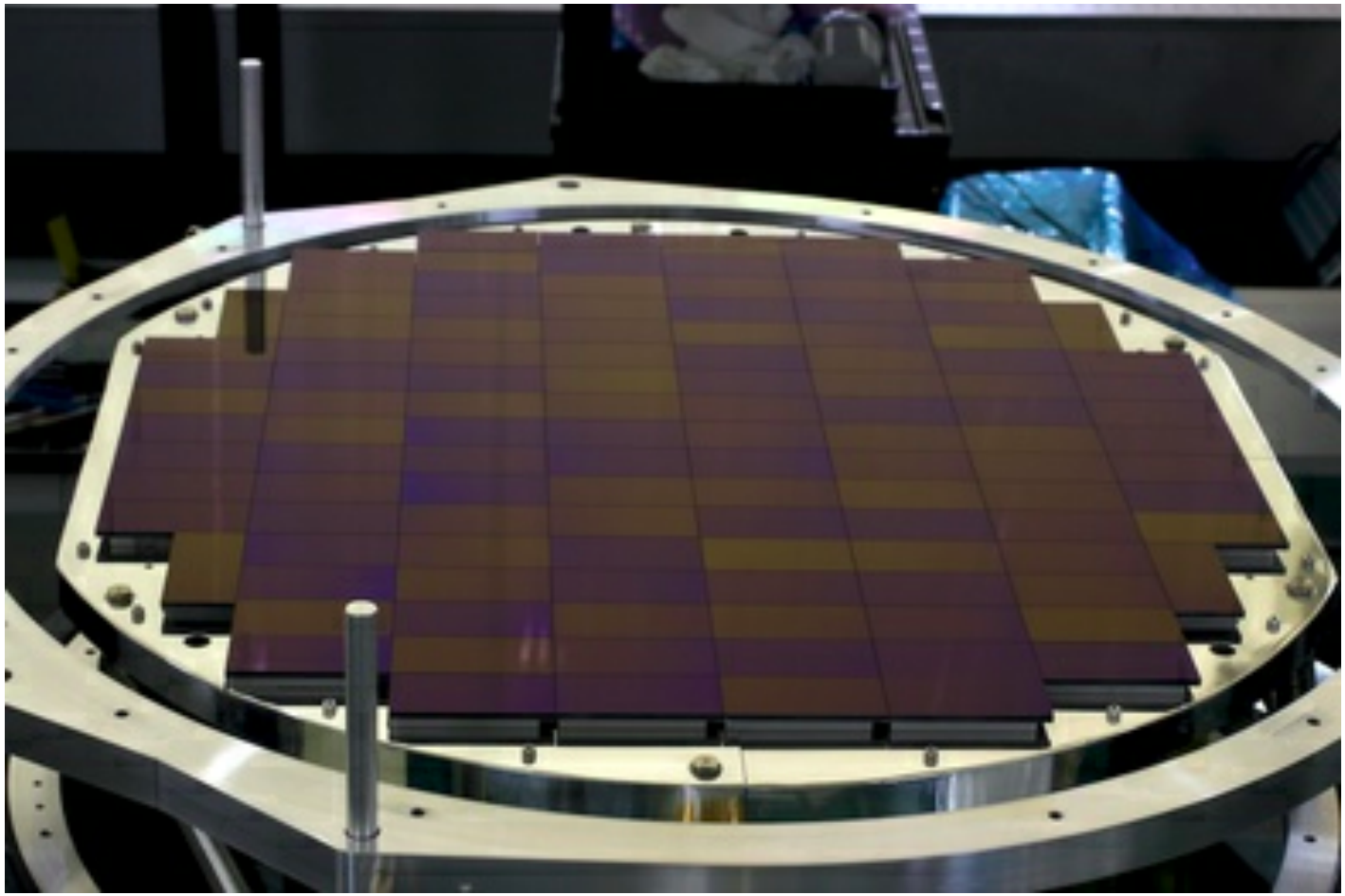


Subaru
Measurements of
Images and
Redshifts: Using the Subaru 8.2m telescope for imaging and spectroscopic surveys of the sky.

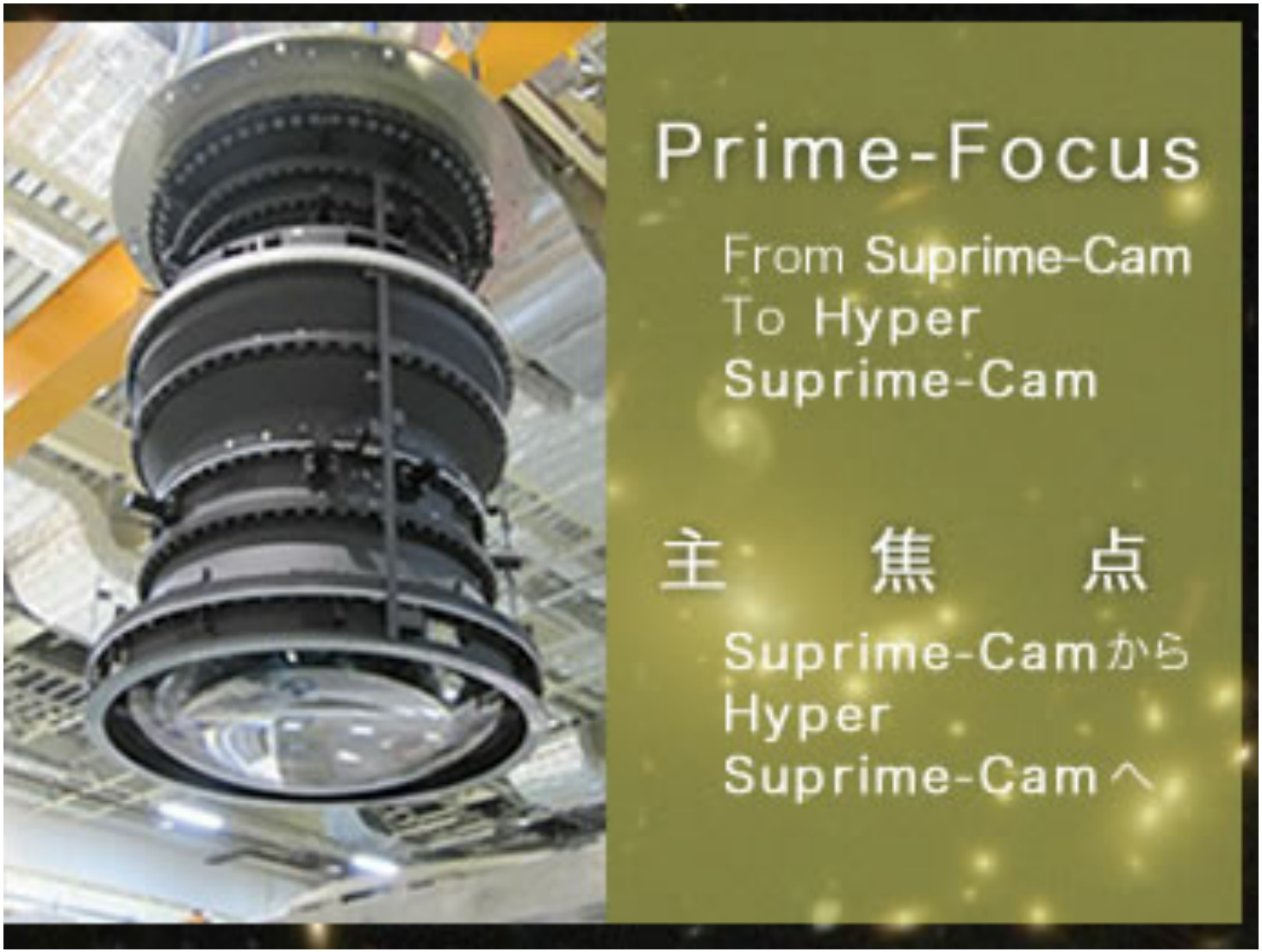
Wide-Field Imager: Hyper-Suprime Cam

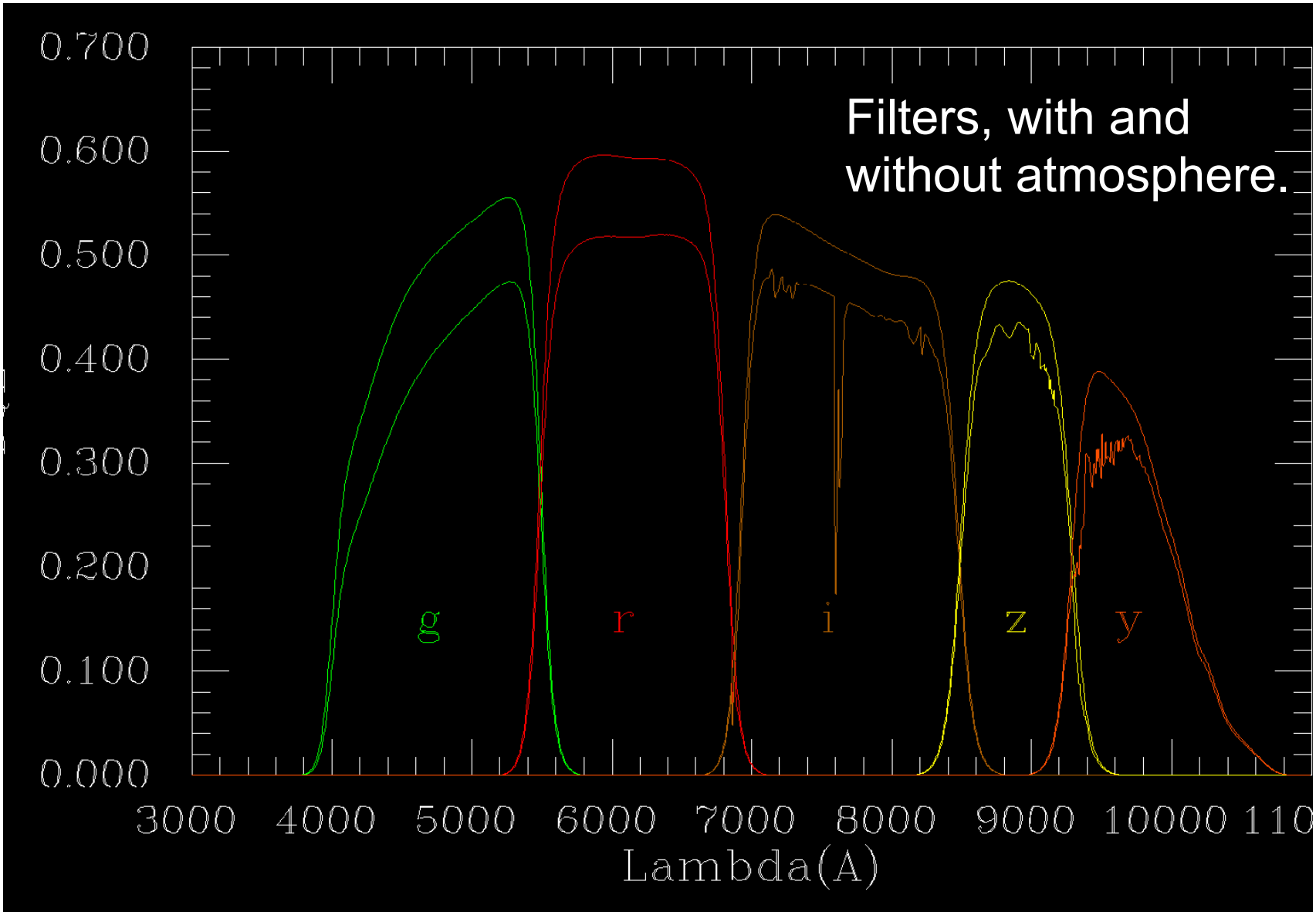
Built by Satoshi Miyazaki and his team at NAOJ,
first light in August.

- 116 2K×4K Hamamatsu Deep Depletion CCDs. 0.16”/pixel, 1.77 deg^2 field of view.



Wide-field Corrector gives <0.2” instrumental PSF over the entire field of view.





Also, narrow-band filters at 387, 527, 718, 816, 921, 1010 nm (z=2.2,3.3,4.9,5.7,6.6,7.3 for Lyα)

We're planning a 300-night imaging survey

- Principal science goals are weak lensing and galaxy evolution.
- Wide layer: 1350 deg^2 in two equatorial fields, *grizy* to 26.4,26.1,25.7,25.1,24.0 (5σ, point source). Median *i*-band imaging of 0.7".
- Deep layer: 4 fields of 7 deg^2 each, about a magnitude deeper, plus NB filters at z=2.2, 3.3, and 4.9.
- Ultradeep layer: 2 pointings of 1.7 deg^2 each, one magnitude deeper still, plus all narrow-band filters.

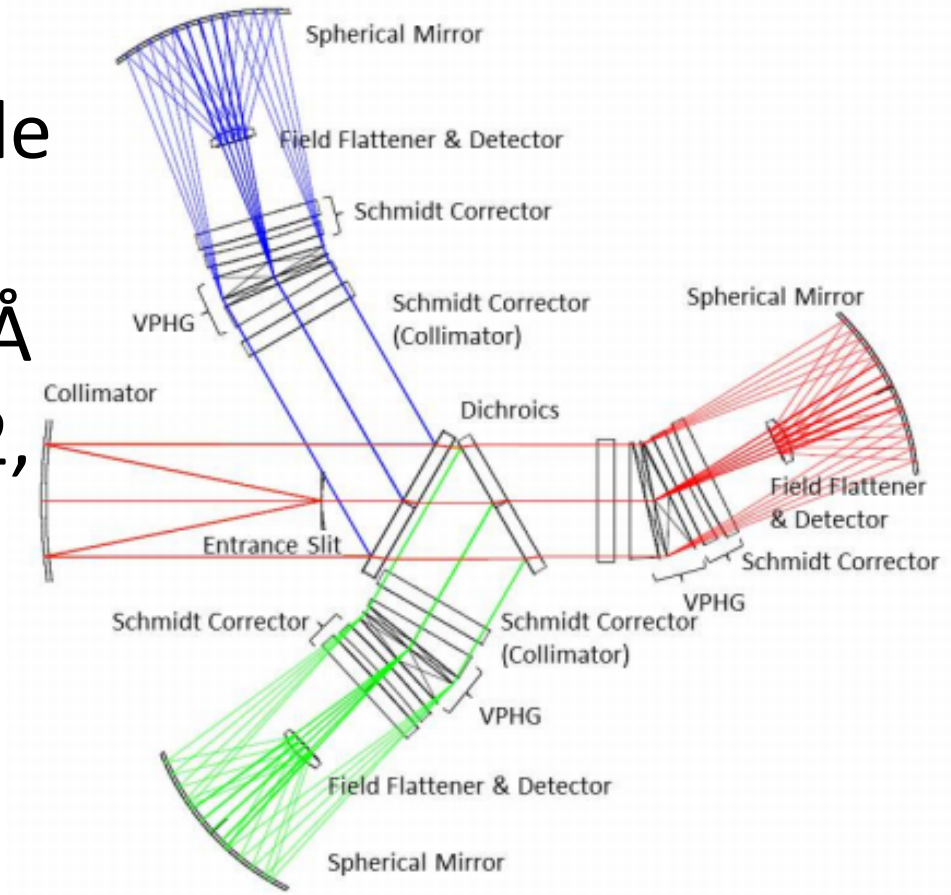
Prime Focus Spectrograph
(see Mike Seiffert's talk)

2400 fibers over 1.1 deg^2, spectral coverage from 380 to 1300 nanometers, resolution ~3Å.

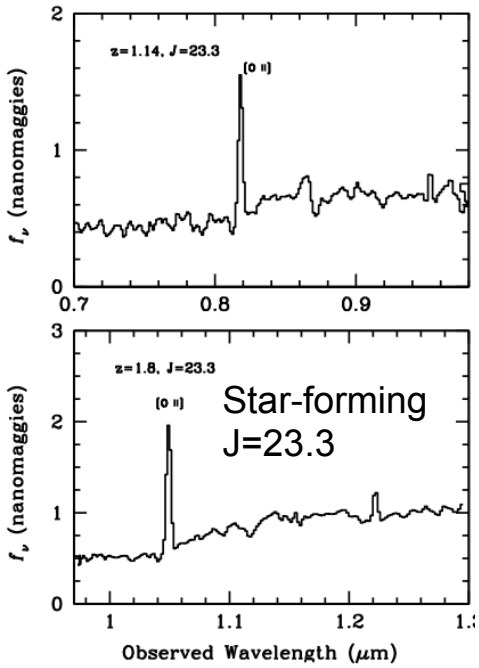
Hα, [OII], or Lyα available at all redshifts 0 to >10.
No redshift desert! 4000Å break observable to z=2.2, Hα to z=1.

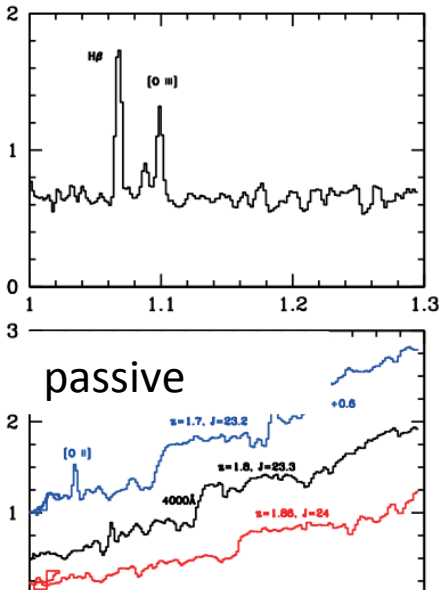
BAO, galaxy evolution, MW archeology

First light 2017?



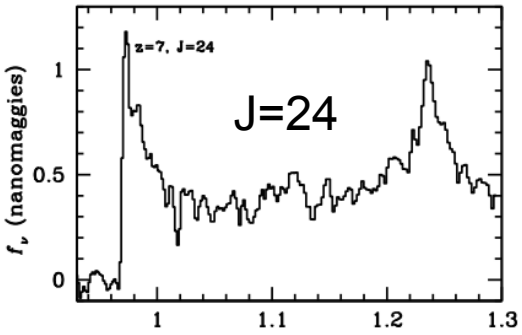
Simulated PFS spectra, binned to R=400

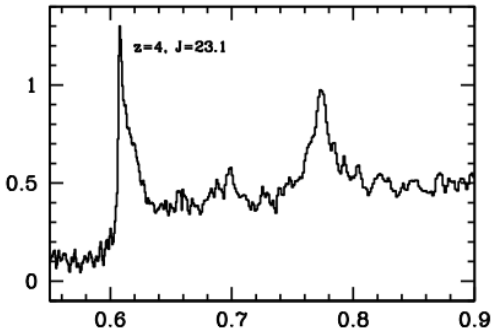




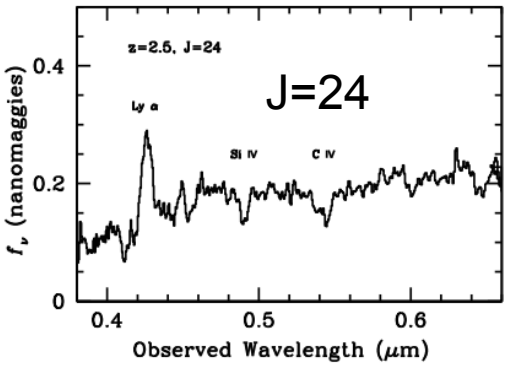
Galaxies, 3 hour integration

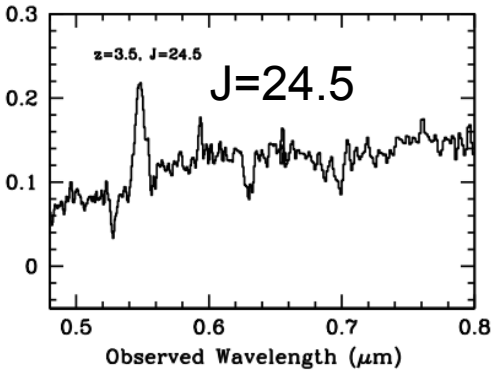
Quasars, 30 min





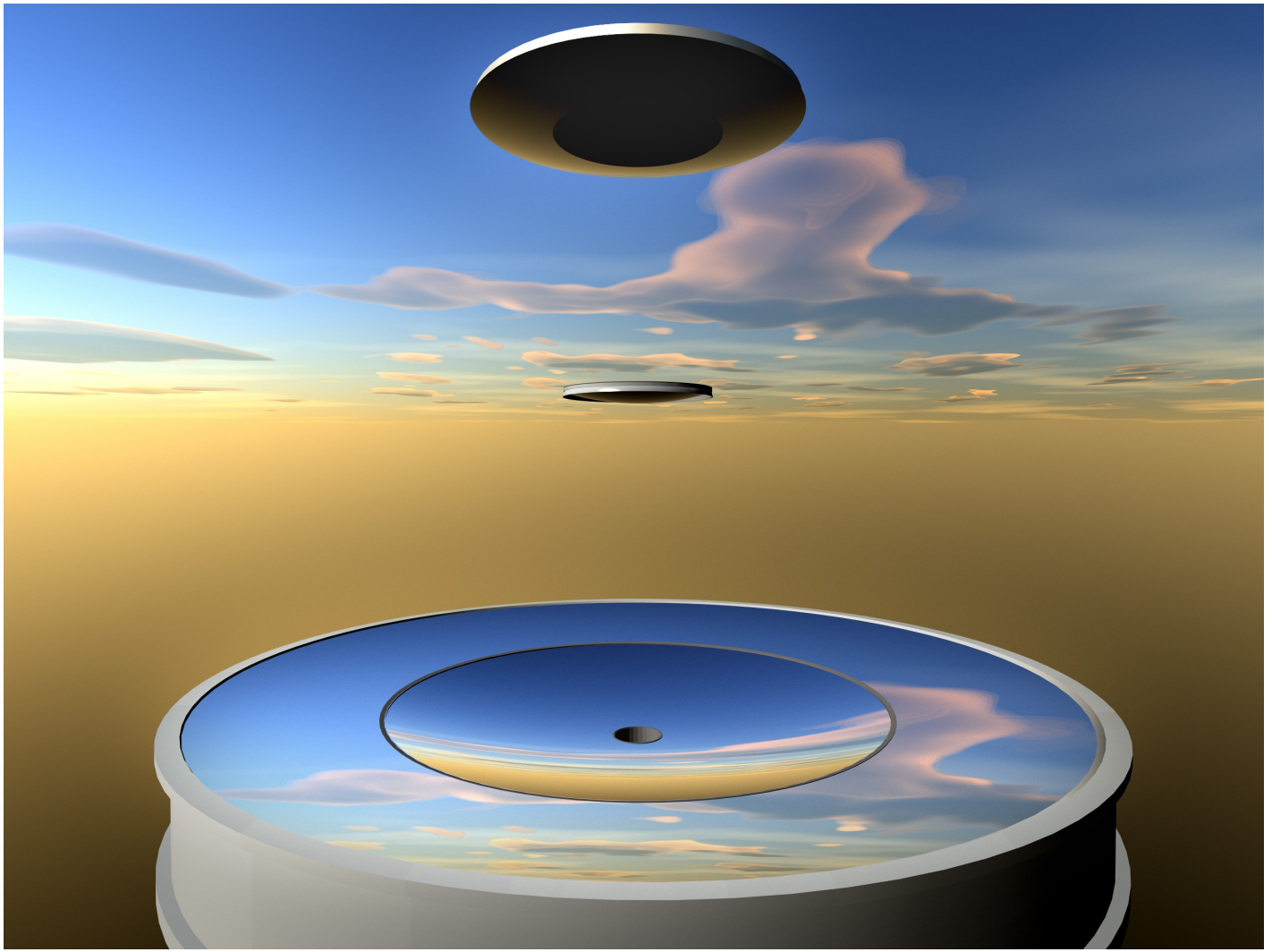
Lyα emitters, 6 hours





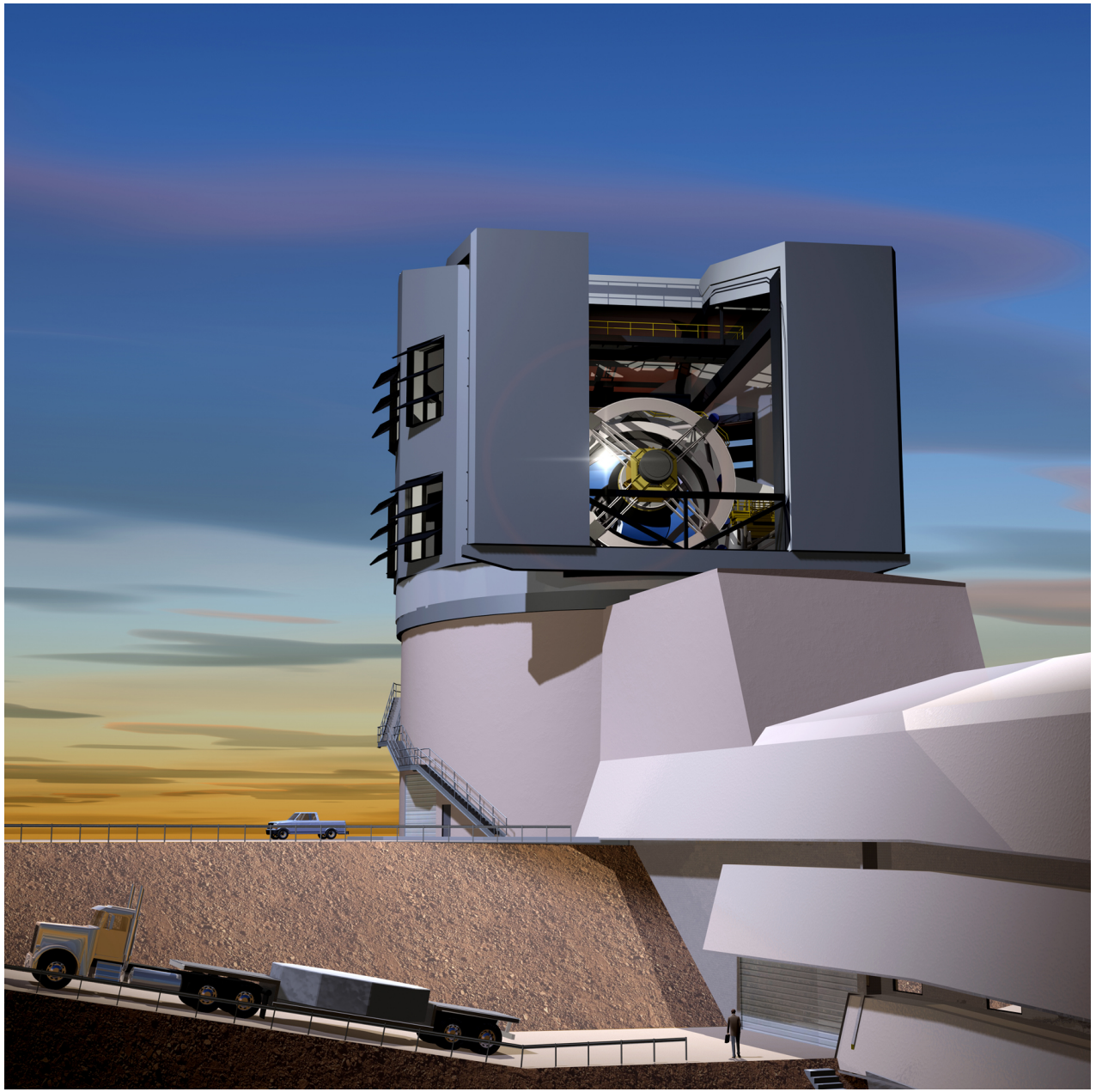
LSST: A 6.7-m survey telescope, 9.6 deg^2 field of view

Telescope will be dedicated to a ten-year imaging survey of 18,000 deg^2 in 6 filters.

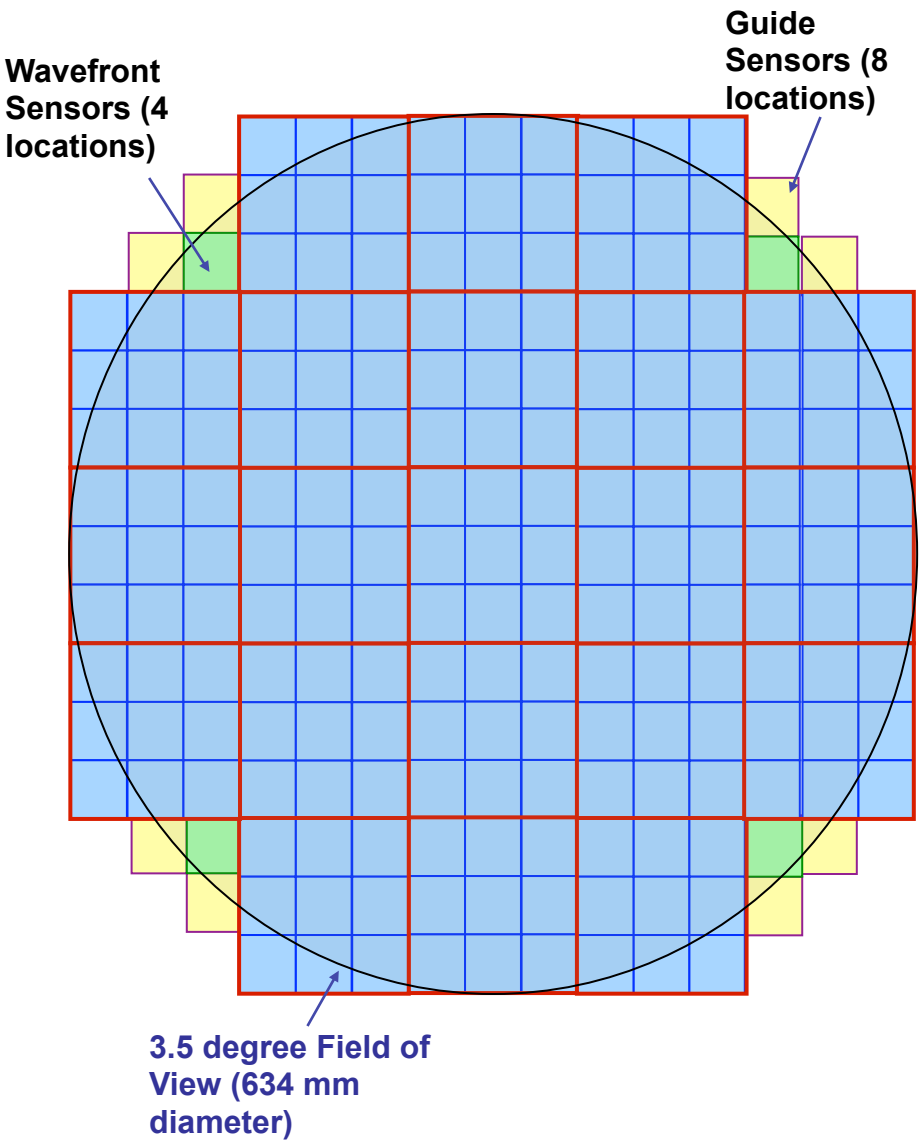


Primary/Tertiary after casting

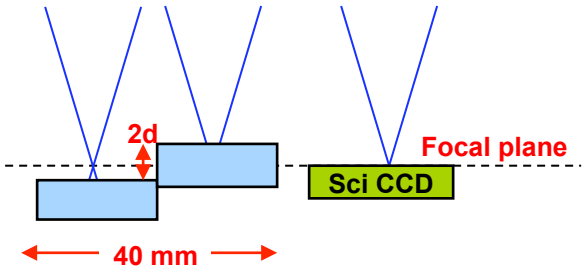
Cerro Pachón, Chilean Andes



The LSST Focal Plane

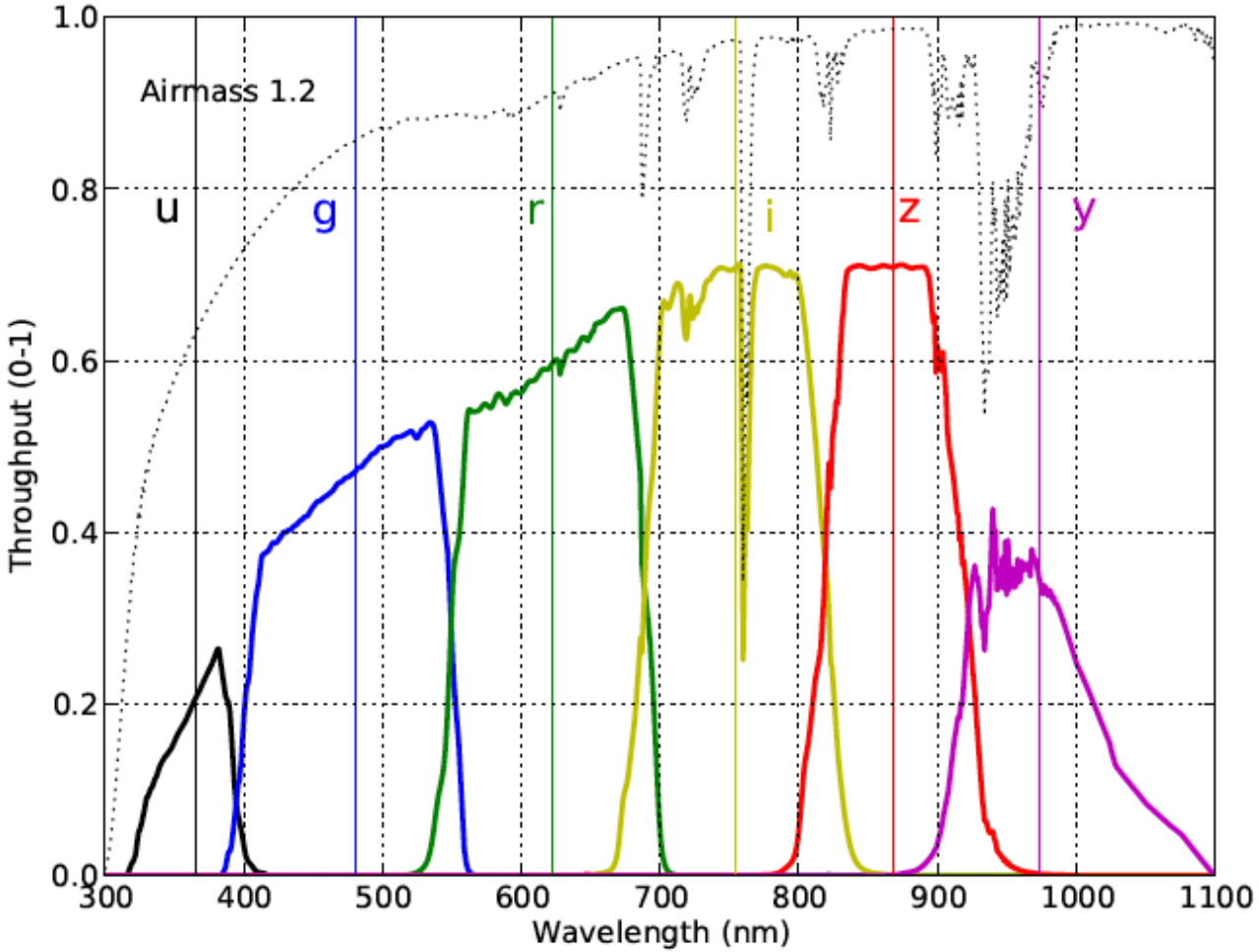


Wavefront Sensor Layout



Curvature Sensor Side View Configuration

Photometric system similar to HSC and DECam



LSST: A dedicated 10-year survey

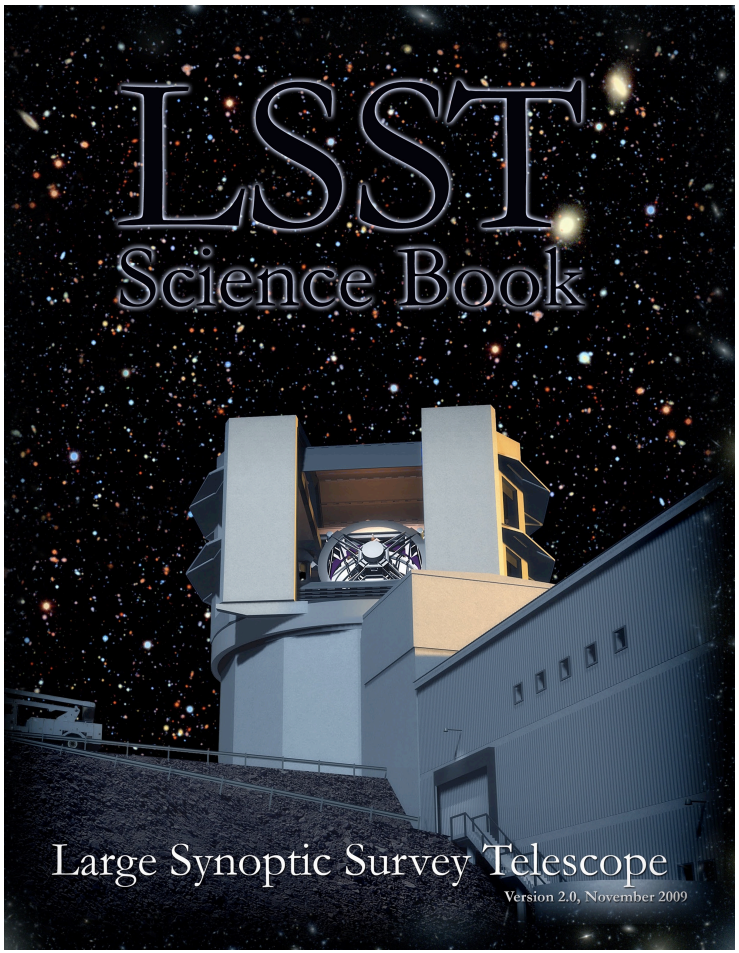
- Main survey will cover 18,000 deg^2, 2000 15-sec exposures across 6 filters at each point in the sky.
- 5σ point-source depth after two exposures: 23.9 (*u*), 25.0 (*g*), 24.7 (*r*), **24.0** (*i*), 23.3 (*z*), 22.1 (*y*)
- Depth at end of the survey: 26.3 (*u*), 27.5 (*g*), 27.7 (*r*), **27.0** (*i*), 26.2 (*z*), 24.9 (*y*)
- Additional surveys of Galactic and ecliptic planes; South Pole.
- Perhaps 10% of the time will be devoted to 'deep fields' ~1 mag deeper; cadence good for faint Kuiper Belt Objects, good light curves for supernovae, and short-timescale transients. ***20 trillion observations of 20 billion objects***

Extremely high-quality data

- Median delivered image quality of 0.67".
- Can cover all the available sky in a given filter in roughly 3 nights.
- Probes of variability on timescales from 15 seconds to 10 years.
- Stellar photometric calibration to 1% or better; stellar repeatability to 0.5%.
- Astrometry to 10 mas per visit, allowing proper motions uncertainty of 0.2 mas/year, and parallax uncertainty of 1 mas over the course of the survey. LSST matches Gaia's astrometric precision at r~20, and extends it 4 magnitudes fainter.

LSST Science Collaborations led the writing of the LSST Science Book

Completed November 2009,
245 authors,
15 chapters and 4 appendices.
Available at:
http://www.lsst.org/lsst/scibook



Current status

LSST was the top-ranked ground-based project in the Decadal Survey.

Construction cost of ~US$400 million. Operations of $37 million per year.

Our plan: US Department of Energy will build the camera; National Science Foundation will pay for telescope and data systems. We have passed NSF PDR and DOE CD-1. Important joint NSF/DOE review underway as we speak; then to the NSB to be put on the MREFC queue?

With luck, we will be able to start construction in Fall 2014; scientific first light in late 2019, with the start of the 10-year survey a year later.

Follow-up of LSST targets?

- Spectroscopy of unusual LSST discoveries (e.g., transients, color outliers, etc.)
- Spectroscopy of large statistical samples of galaxies (photo-z calibration), stars, supernovae, quasars, etc. Strong possible synergy with DESpec!