



Status of the Rubin Observatory and Cosmology with LSST

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LHC Days
Hvar, Croatia
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Project overview

- D=8.4-m (6.5-m effective)
- 3.5 deg FOV
- 3.2 Gpix camera, 2 s readout,
- Cerro Pachón, Chile
- 40 TB/night
- ~40 billion stars and galaxies
- Image the whole visible sky every 3 nights for 10 years in *ugrizy* bands

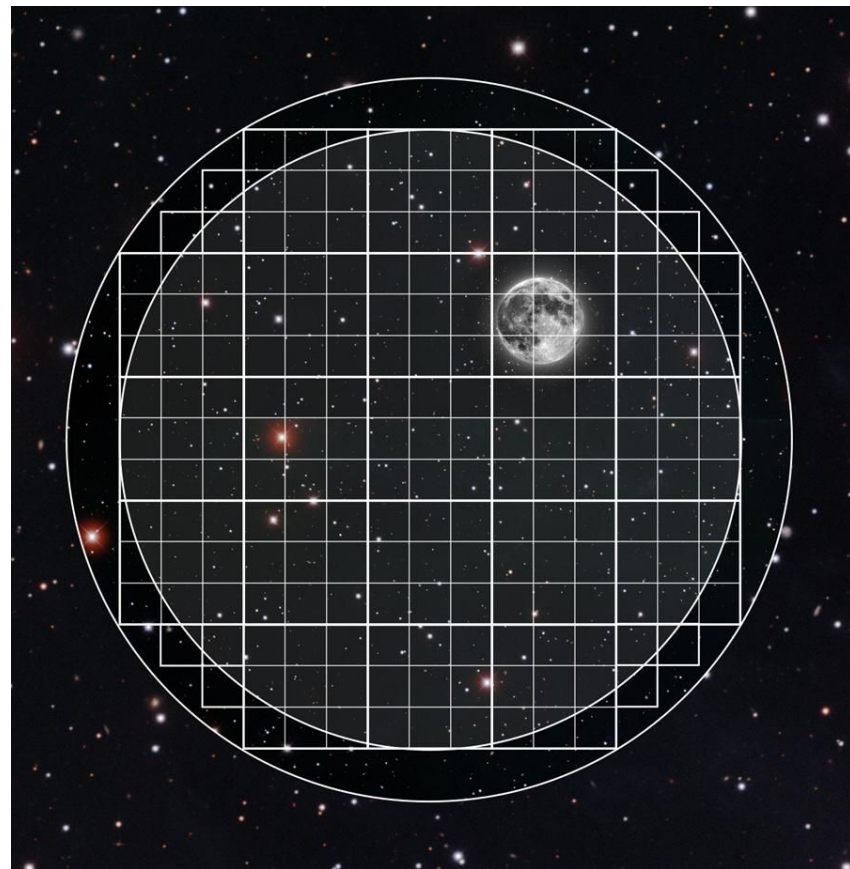


- Key metric: *étendue*
 - Product of the mirror area and the FOV size
 - Faint & wide

- First light: ~Jun '25
- Survey start: ~late '25
- DR1: SS+~1yr

Project overview

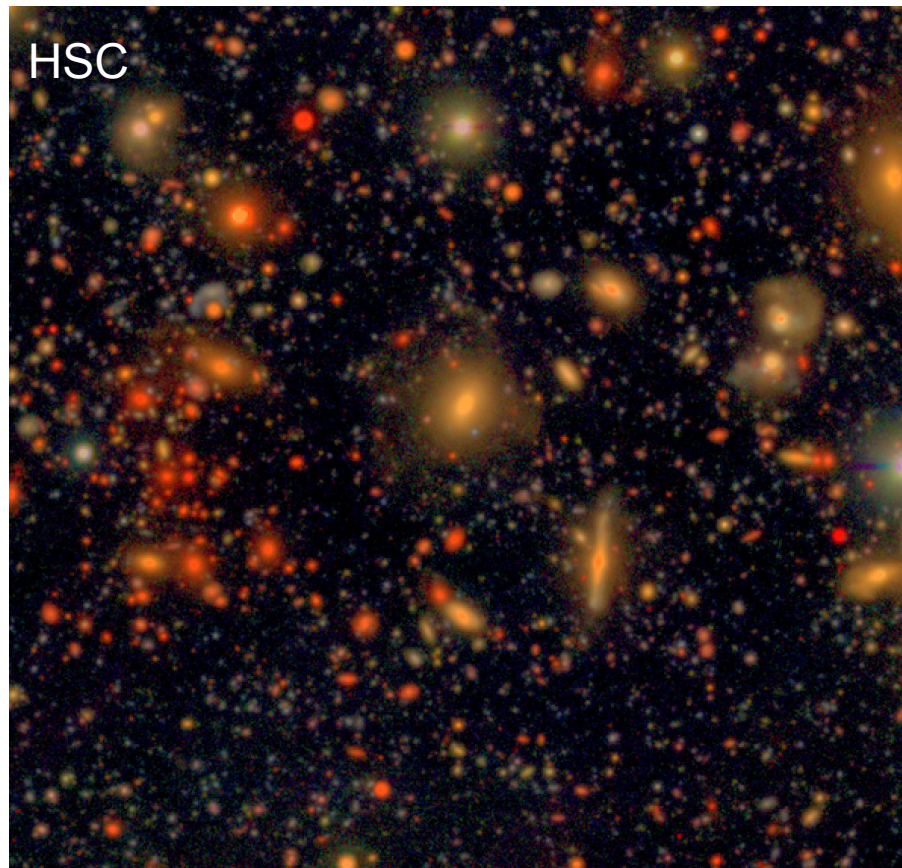
- Key metric: *étendue*
 - Product of the mirror area (faint) and the FOV size (wide)
- With other telescopes, it would take 1000 years to deliver LSST, not 10!



SDSS



HSC



- 3.5'x3.5', $r \sim 22.5$
- LSST FOV 3000x larger

- 3.5'x3.5', $r \sim 27$ (depth like LSST)
- LSST will deliver 5M such images

Science goals

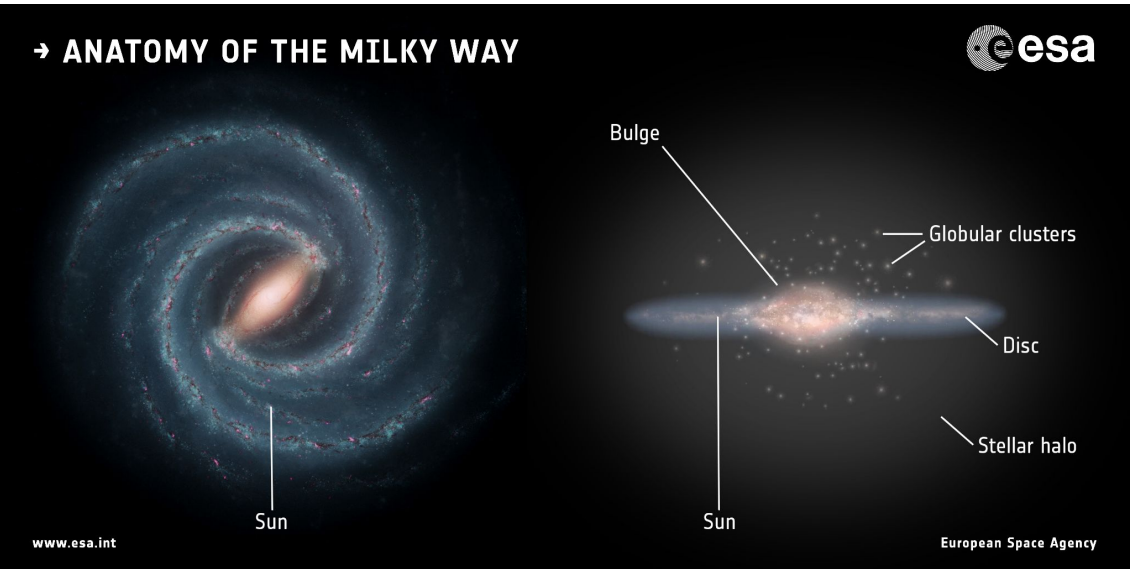
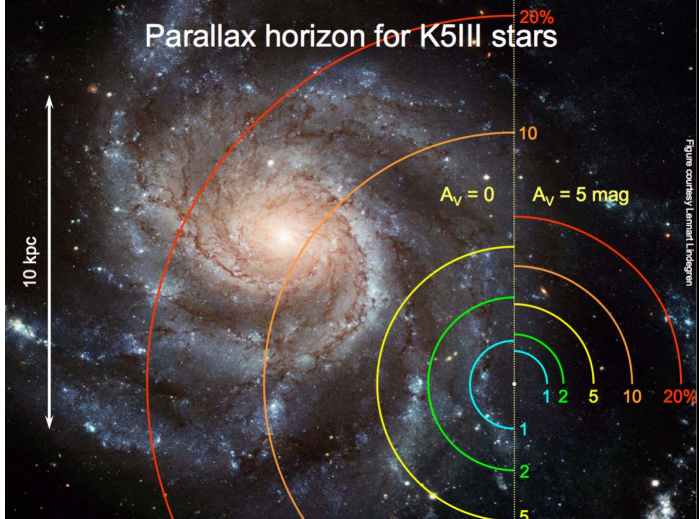
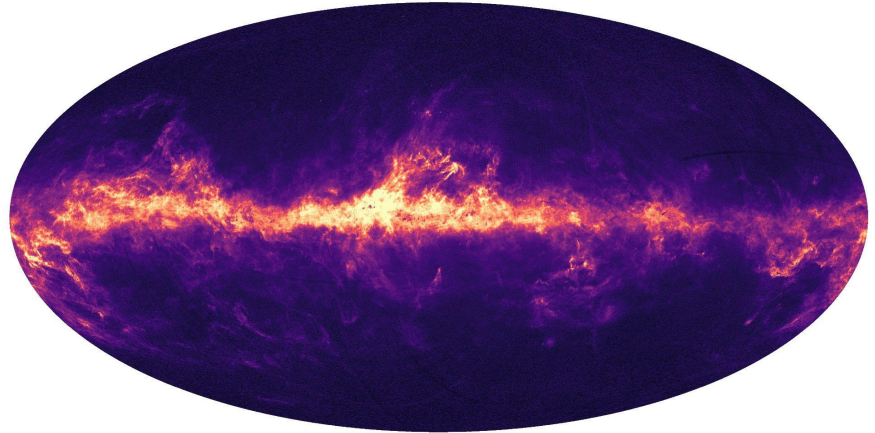


- Exploring the solar system:
 - Complete Inventory of Solar System Objects
 - Killer asteroids $P(\text{impact}) > 0$
- Mapping the Milky Way
- Transient Phenomena
- Understanding Dark Matter & Dark Energy



Science goals

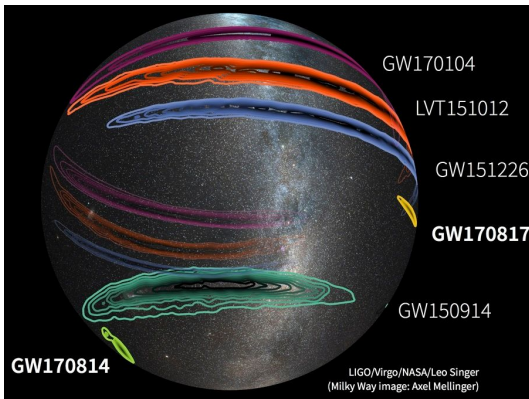
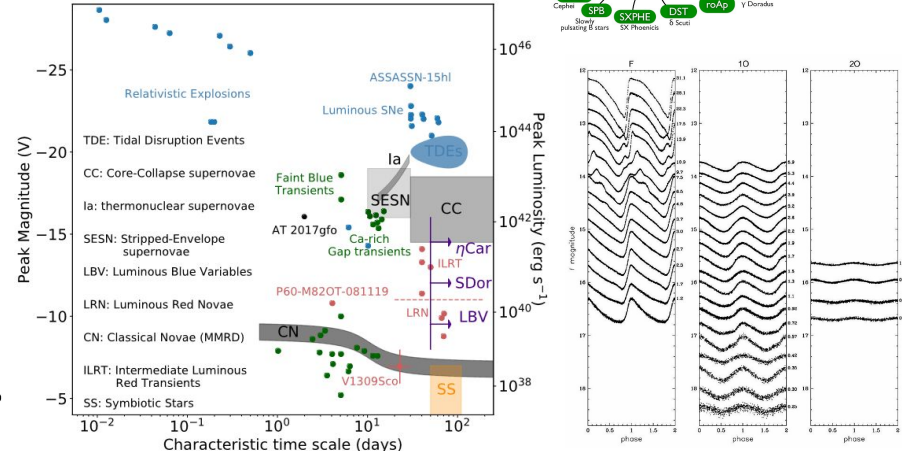
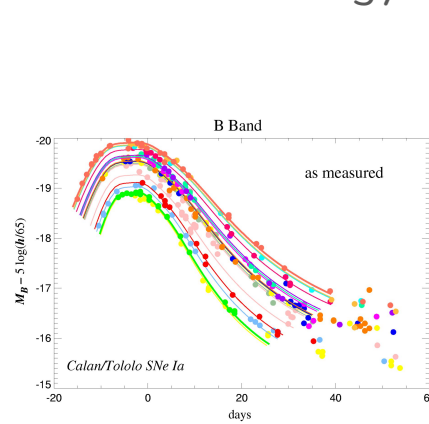
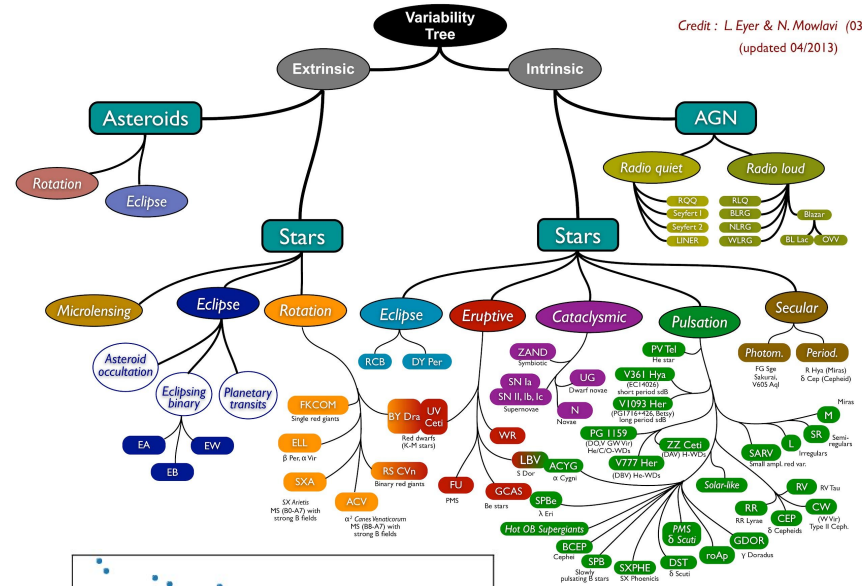
- Exploring the solar system
- **Mapping the Milky Way**
- Transient Phenomena
- Understanding Dark Matter & Dark Energy



Science goals

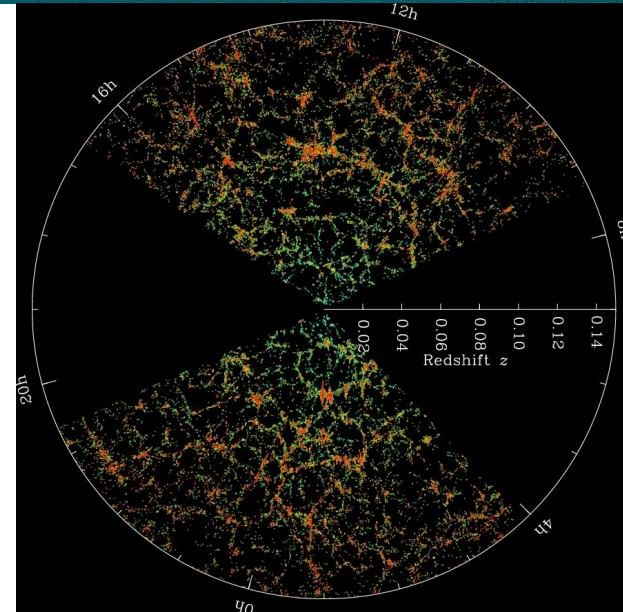
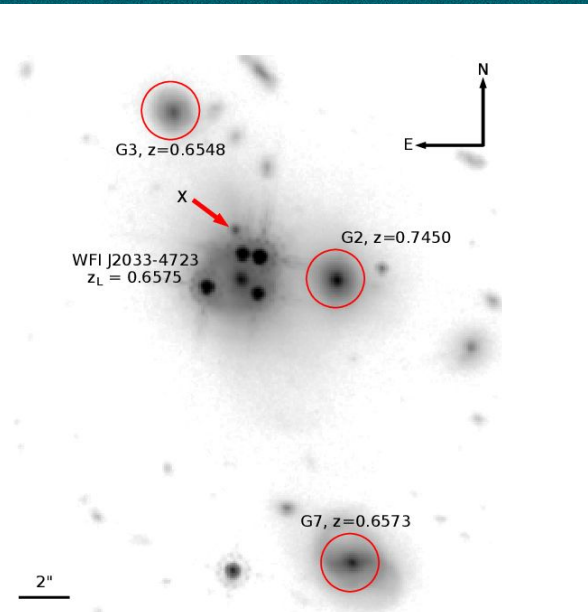
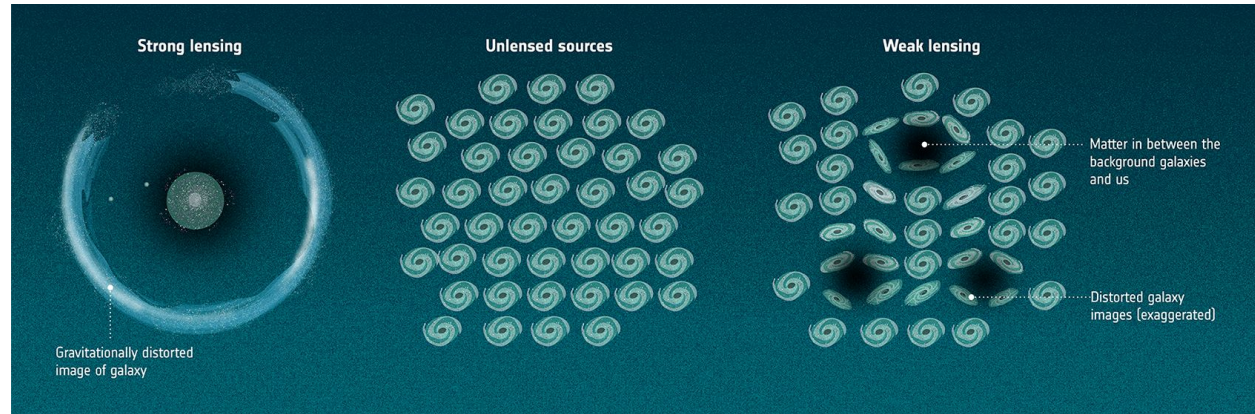
- Exploring the solar system
- Mapping the Milky Way
- Transient Phenomena:
 - (GL) Supernovae, TDEs...
 - Variable stars, quasars, AGNs
 - optical counterparts of GW, GRB, FRB...
- Understanding Dark Matter & Dark Energy

Credit : L. Eyer & N. Mowlavi (03/2009)
(updated 04/2013)



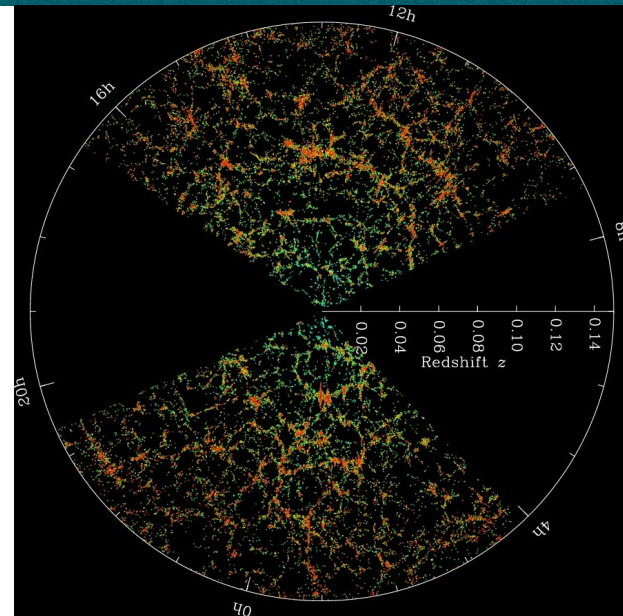
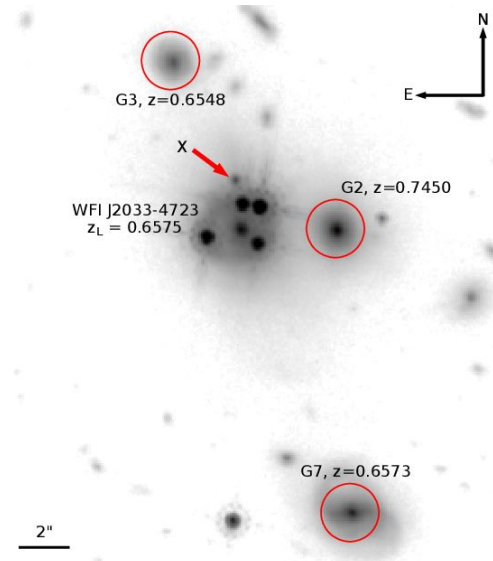
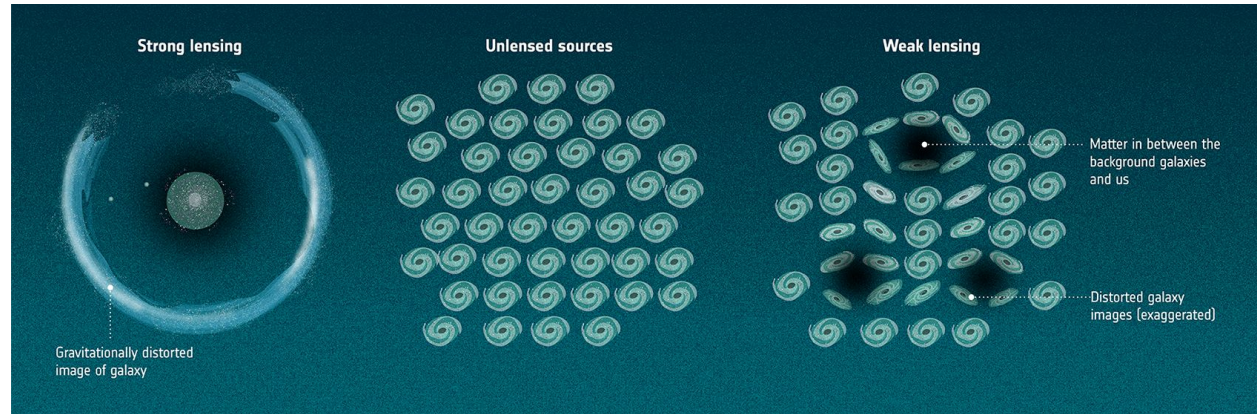
Cosmology

- Exploring the solar system
- Mapping the Milky Way
- Transient Phenomena
- **Understanding Dark Matter & Dark Energy**



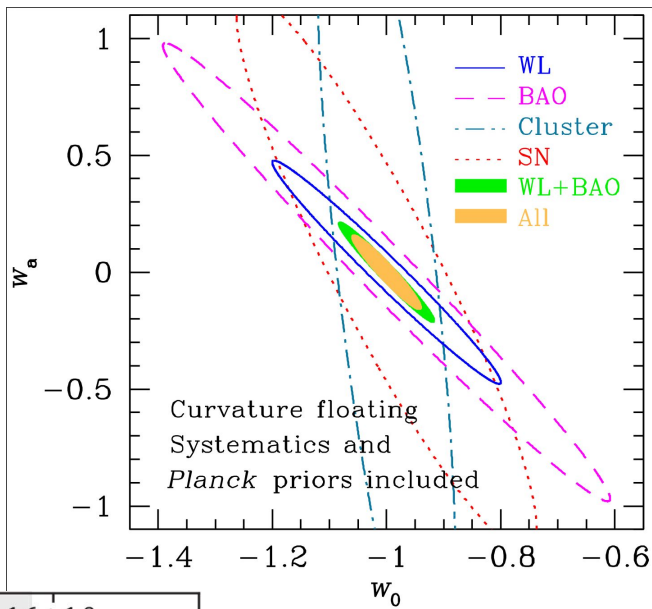
Cosmology

- (Supernovae)
- Baryon Acoustic Oscillations
- Strong & Weak Lensing
- Anisotropic dark energy & other large scale measurements
- Gravity, simulations...



Science goals

- Exploring the solar system
- Mapping the Milky Way
- Transient Phenomena
- **Understanding Dark Matter & Dark Energy**
 - \Rightarrow Provide interlocking tests



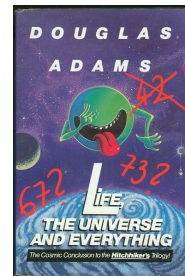
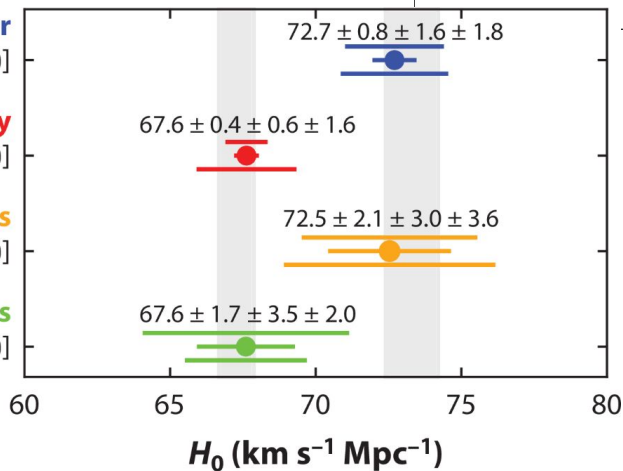
Late, ladder
Cepheids + TRGB (CCHP) + Miras + SBF [family 1(15)]

Early
Planck + ACT + SPT + WMAP + BAO + BBN [family 2(25)]

Late, distances
Time delay + Standard sirens + Masers (no NGC 4258) [family 3(13)]

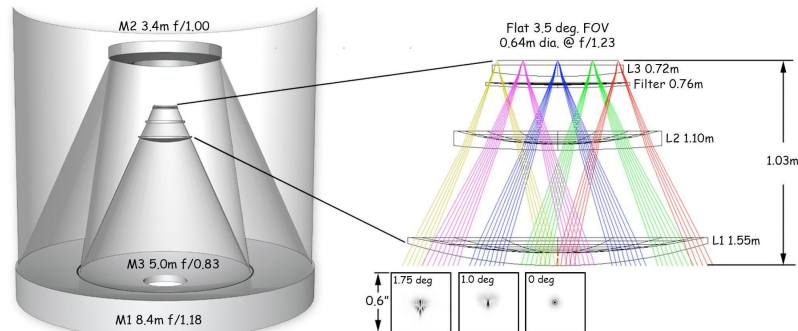
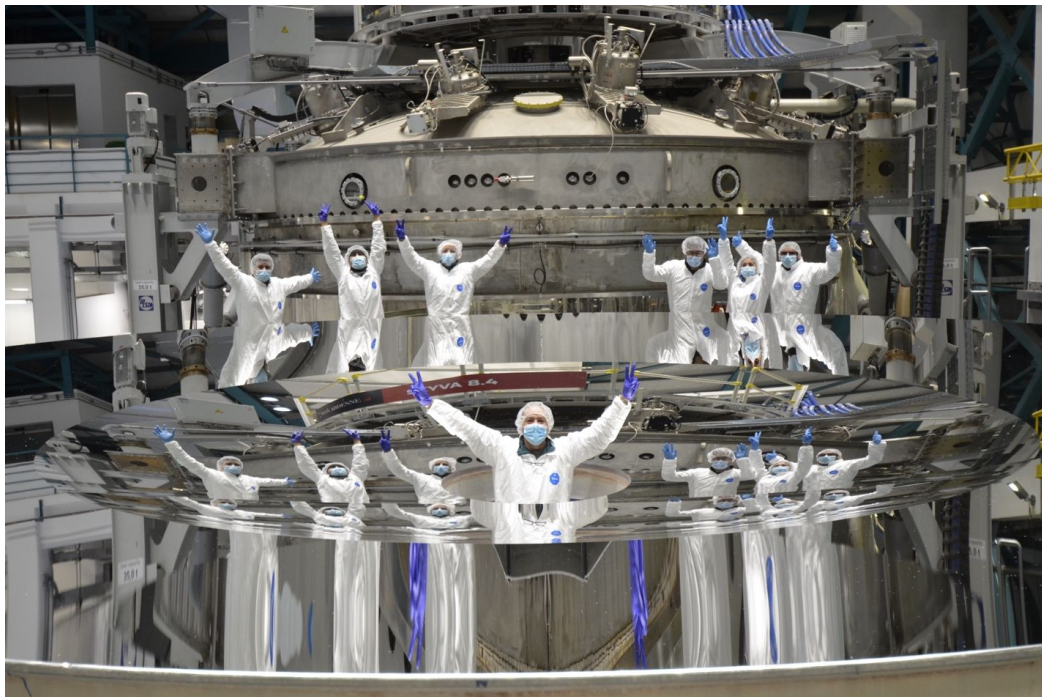
Intermediate, times
Chronometers (Pantheon+) + Age [family 4(4)]

Verde+24



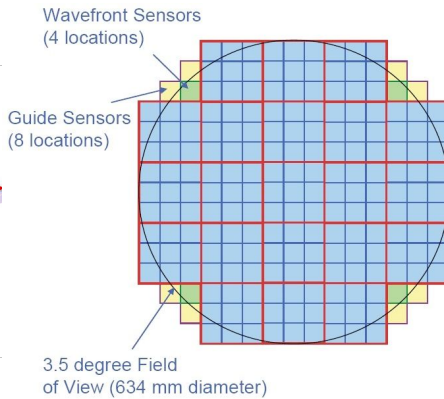
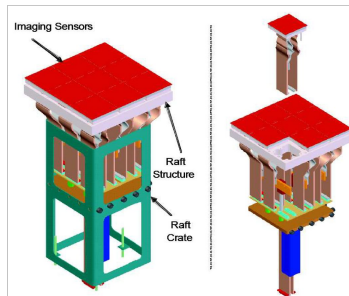
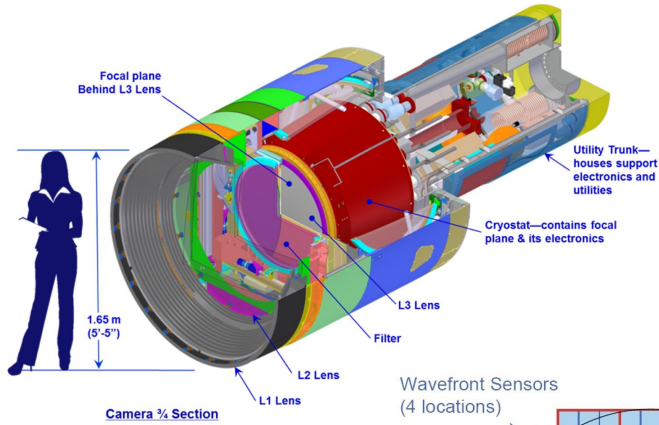
Mirror & filters

- Three-mirror (Eisenberg-Pearson) anastigmat: corrected for spherical aberration, coma and astigmatism
- 8.4-m (6.5 m effective), $f/1.234$
- *ugrizy* (320-1050 nm)
- Final co-added depth: $r \sim 27.5$



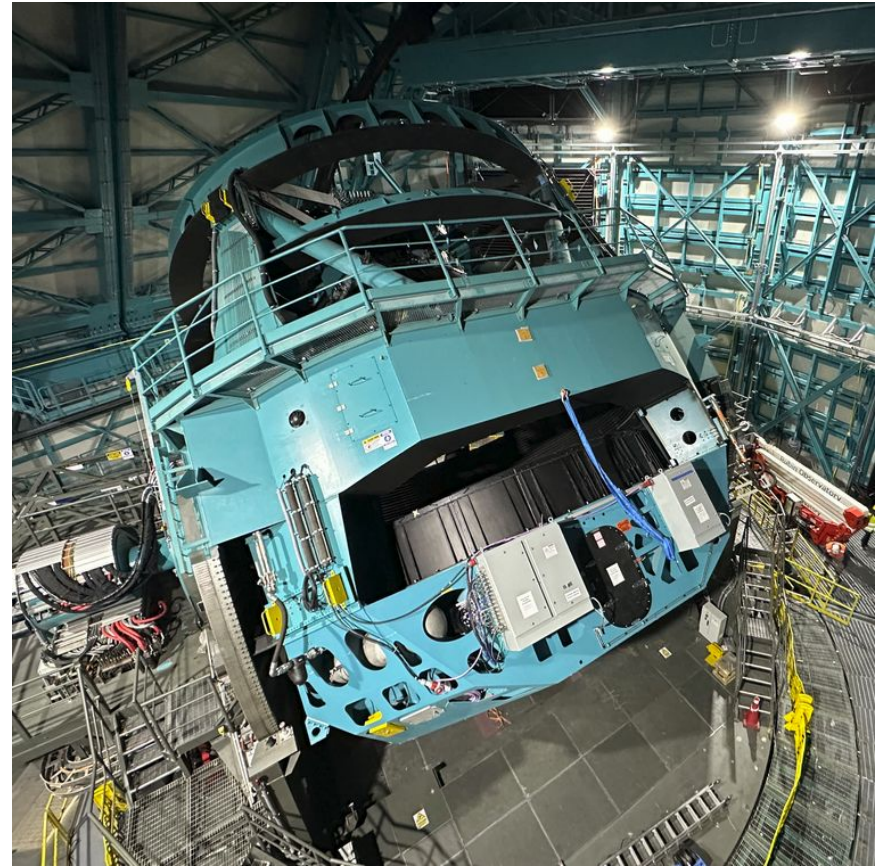
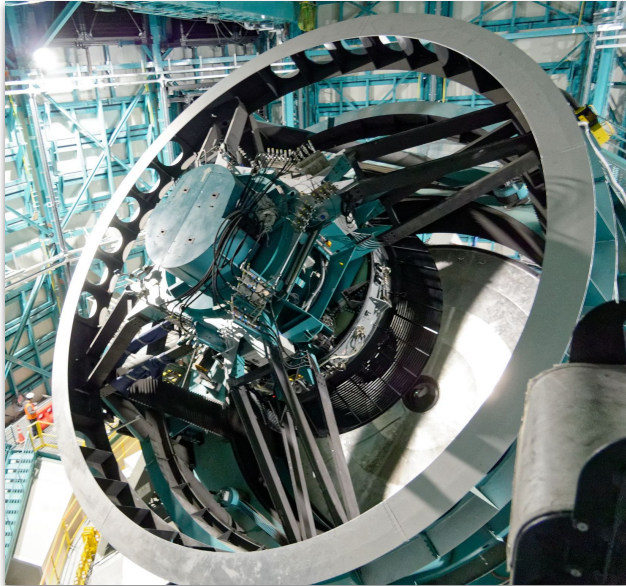
Camera

- 3.2 Gpix, 2s readout
- 0.2"/pix



Mount

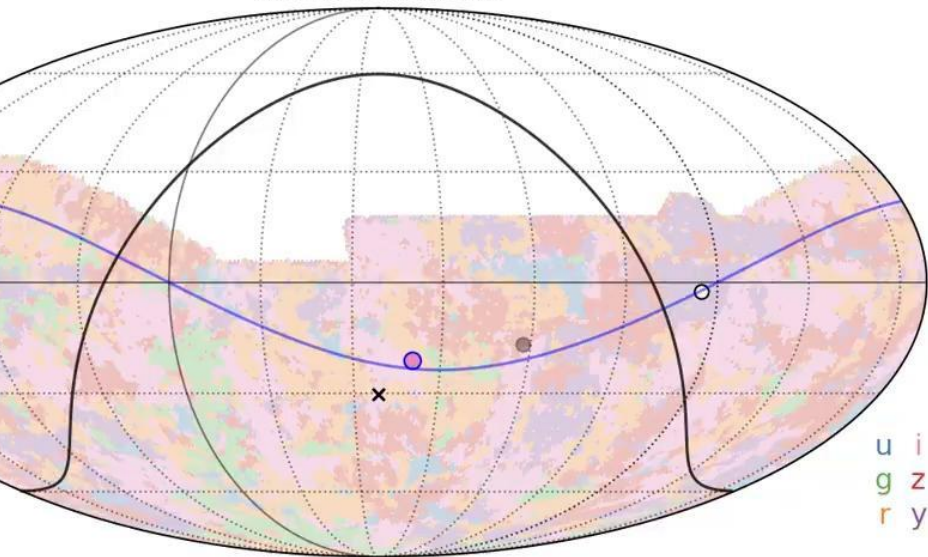
- Azimuth: $\pm 10.50^\circ$
- Elevation: $\pm 5.25^\circ$
- Pointing acc.: $< 1.0''$





Year 08 Night 153 Hour 20:36

baseline_v3.3_10yrs

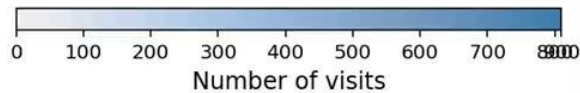
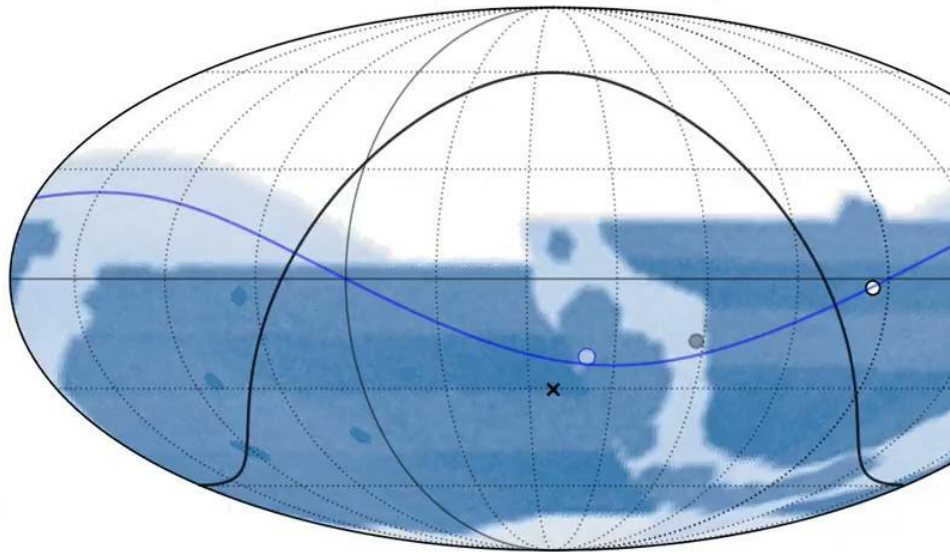


u i
g z
r y

ulated survey pointings on the sky. One visit is ~40 seconds real-time.

- Horizon ○ Sun ● Moon (Dark=Full)
- Ecliptic × Zenith (Light=New)

Cumulative visits (all bands)



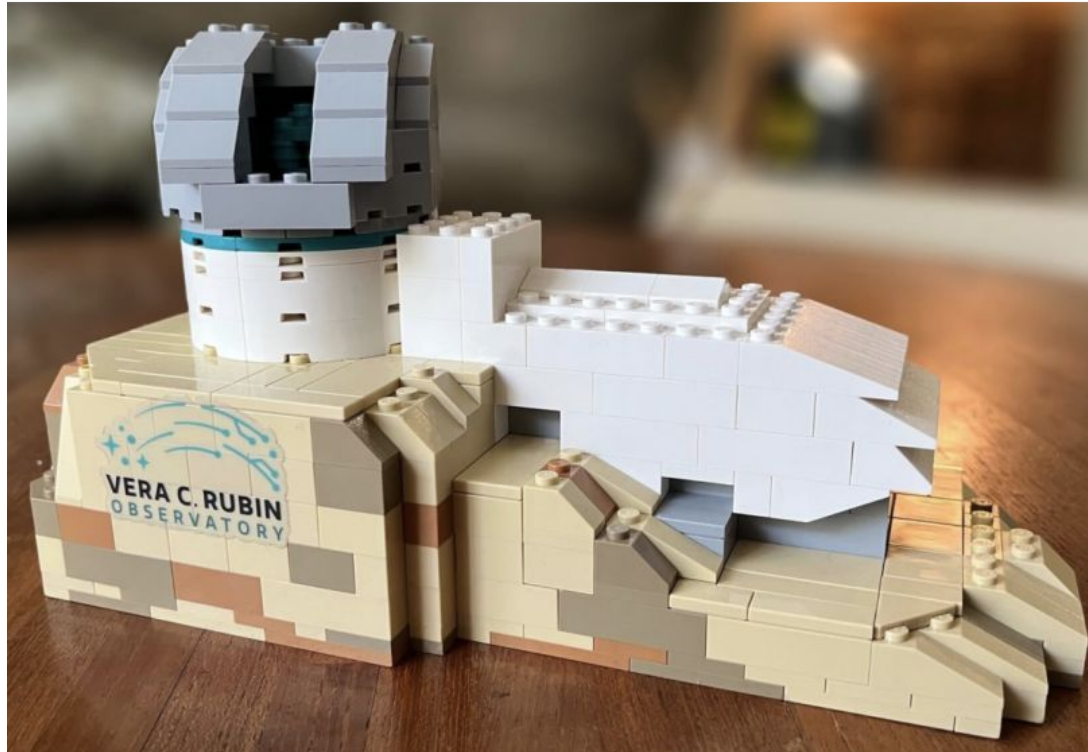
Construction status

- Almost done!
- TMA essentially completed
- LSSTCam at the summit
- M1M3 and M2 coated and in their cells
- M2 and ComCam are on TMA, M1M3 soon, too
- First on-sky images with ComCam in October
- LSSTCam on TMA in early '25



Integration, commissioning and smooth transition from construction to operations

Thank you for your attention!









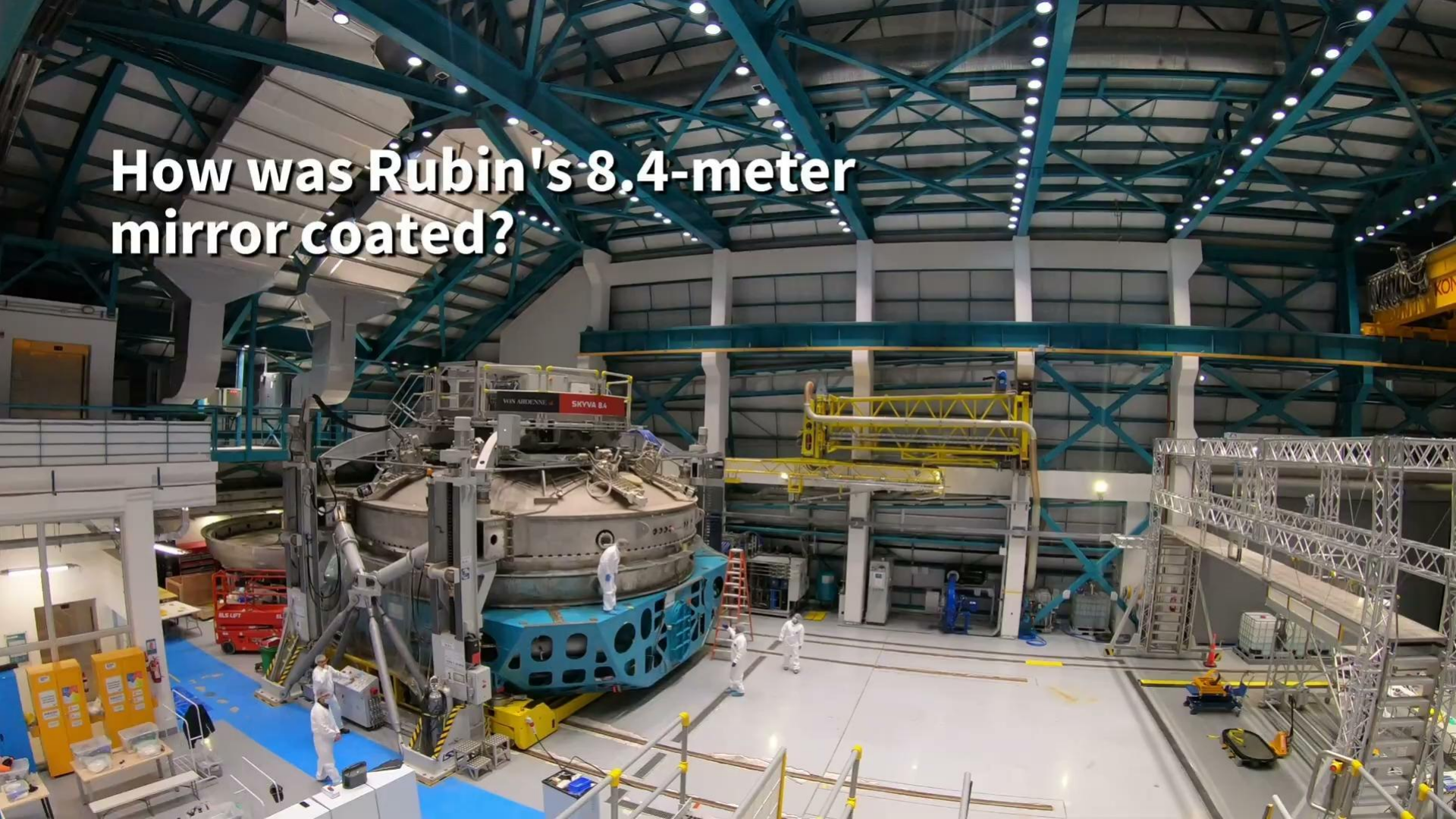
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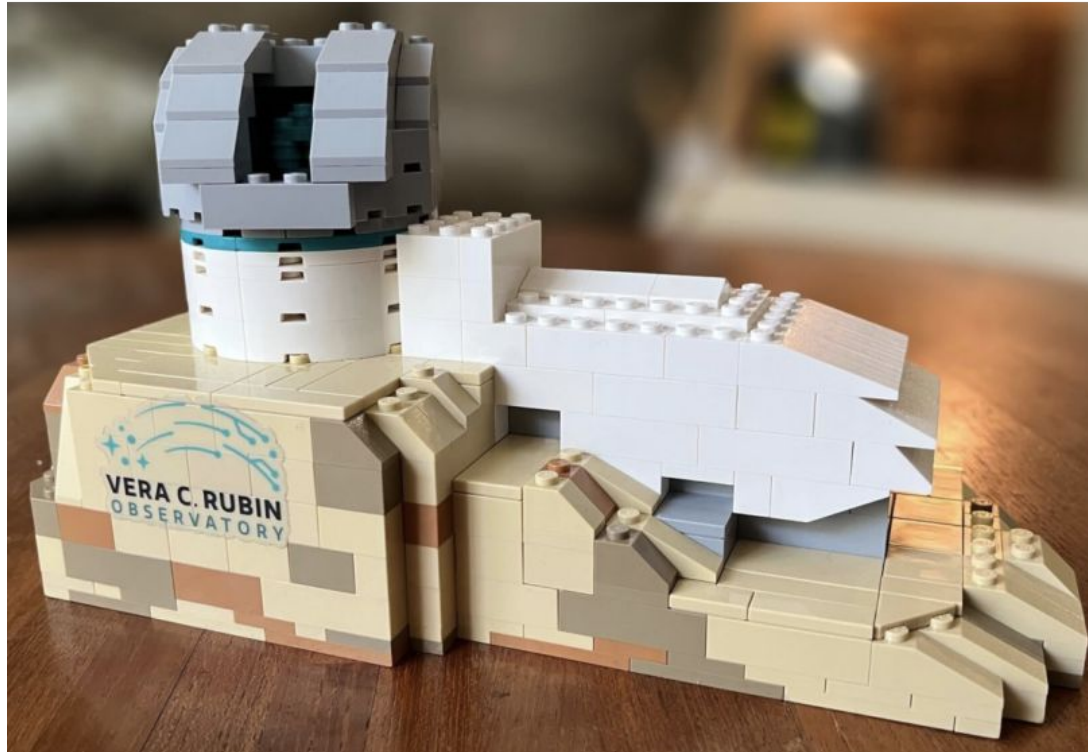
60/1

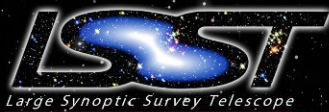


How was Rubin's 8.4-meter mirror coated?



Thank you for your attention!





LSST Operations: Sites & Data Flows

HQ Site

Science Operations
Observatory Management
Education & Public Outreach

Base Site

Base Center
Long-term storage (copy 1)
Data Access Center
Data Access & User Services

French Site

Satellite Processing Center
Data Release Production
Long-term Storage (copy 3)

(and a British site, too!)

Archive Site

Archive Center
Alert Production
Data Release Production
Calibration Products Production
EPO Infrastructure
Long-term Storage (copy 2)

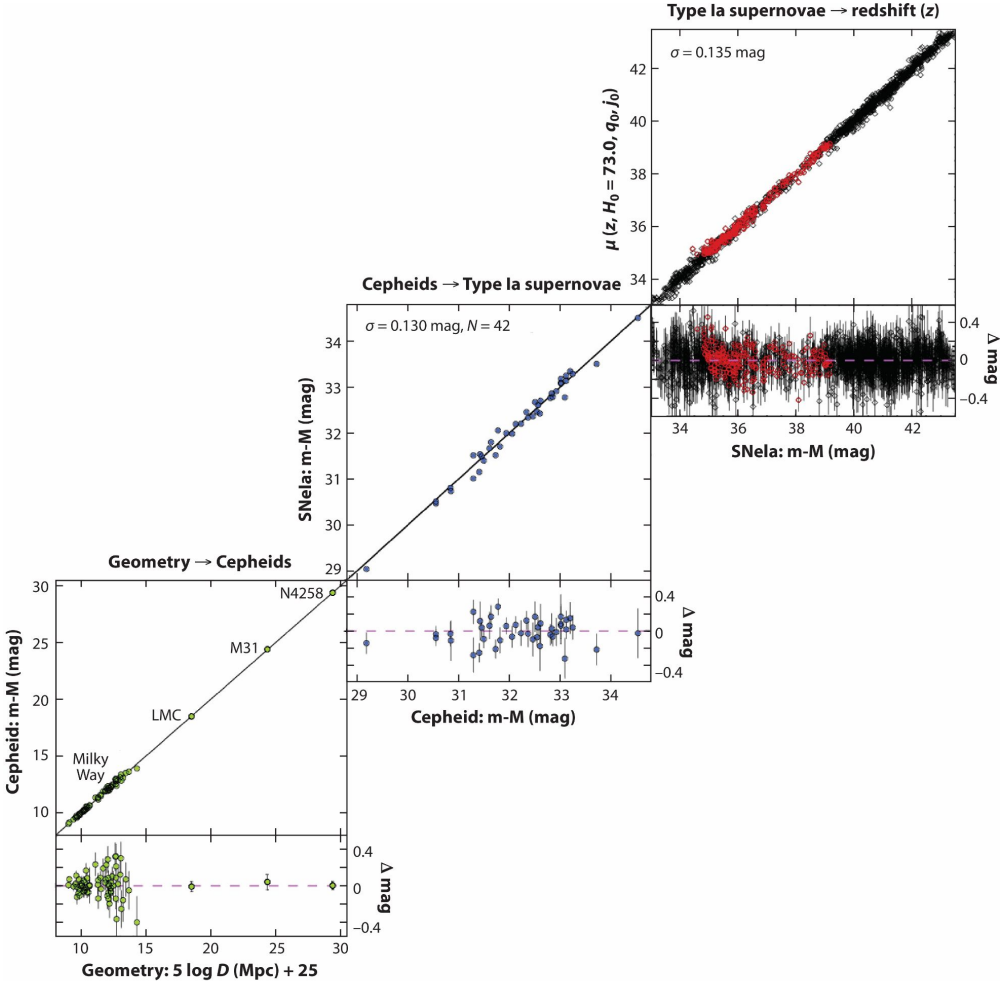
Data Access Center
Data Access and User Services

Summit Site

Telescope & Camera
Data Acquisition
Crosstalk Correction

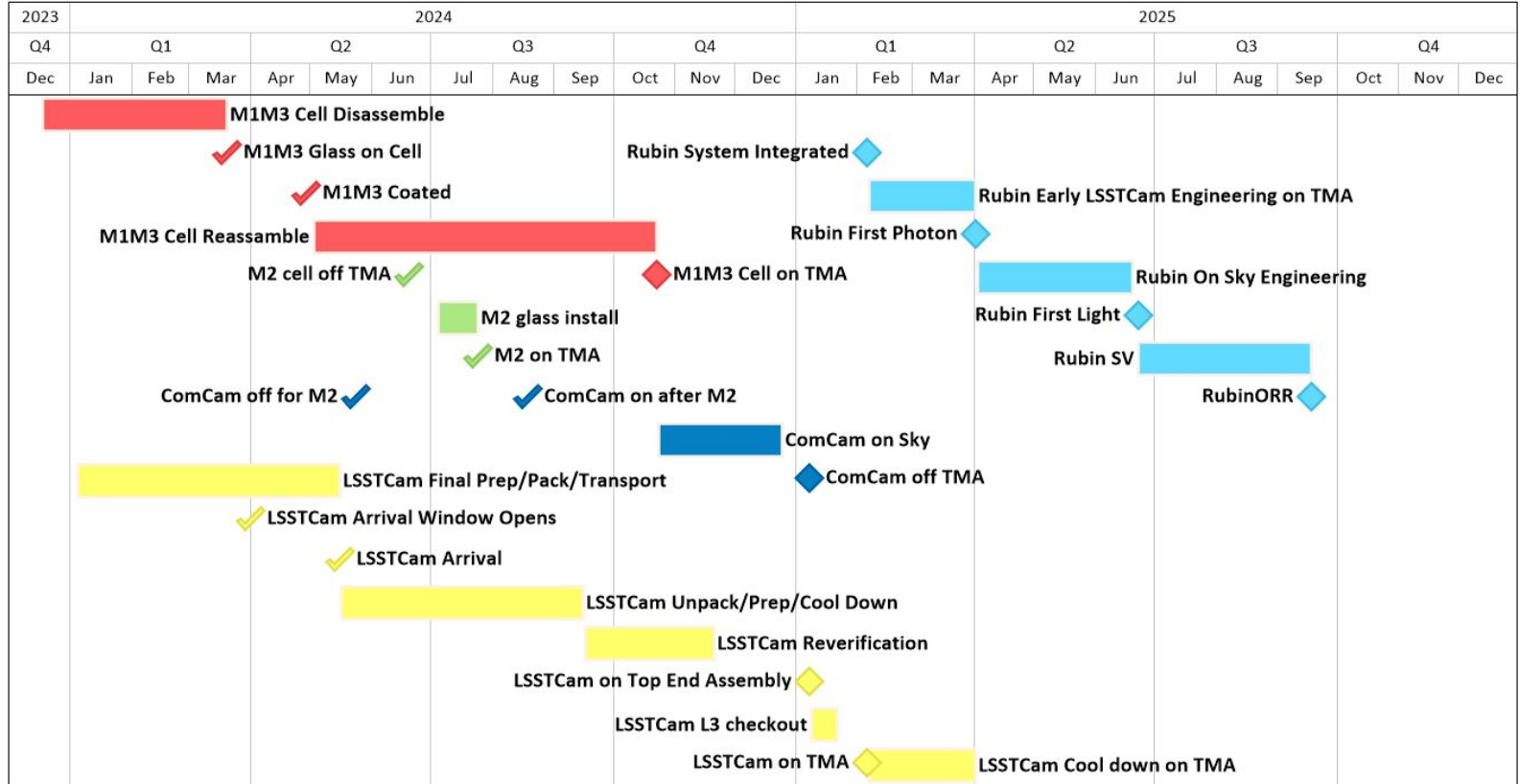


Extra slides



Extra slides

Rubin Key Activities August 2024 Month End



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