ATNF in the Rubin Observatory LSST era

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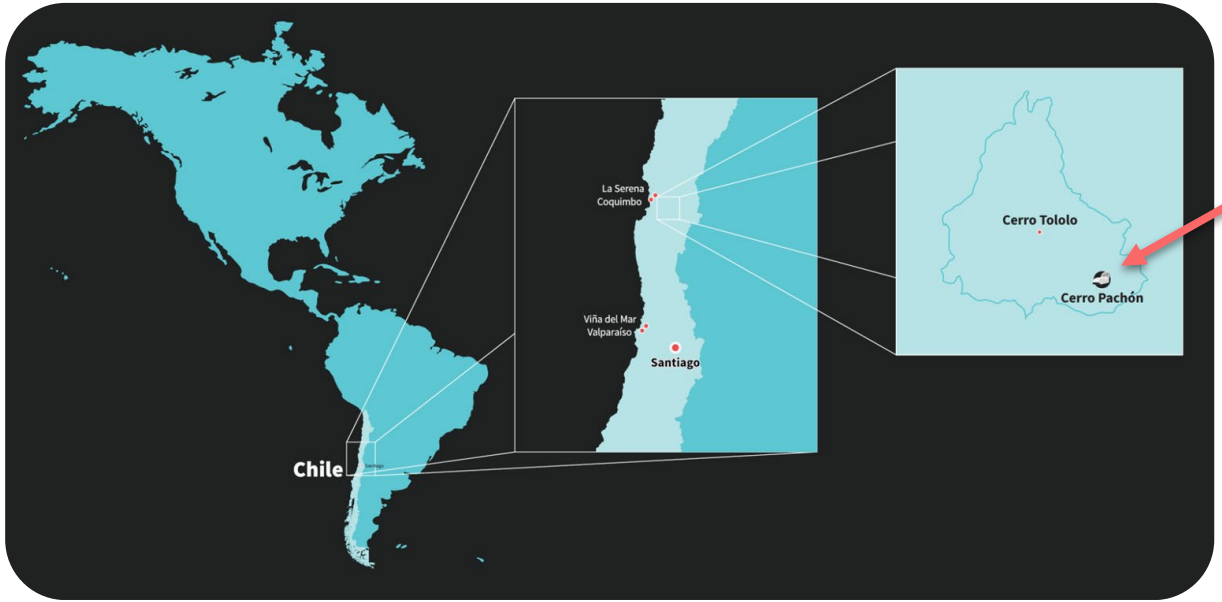
Introducing Rubin Observatory



Located on **Cerro Pachón**, in the Coquimbo region of Chile

Jointly funded by the **U.S. National Science Foundation** and the **U.S. Department of Energy, Office of Science**

VERA C. RUBIN OBSERVATORY | U.S. National Science Foundation | U.S. DEPARTMENT of ENERGY | Office of Science

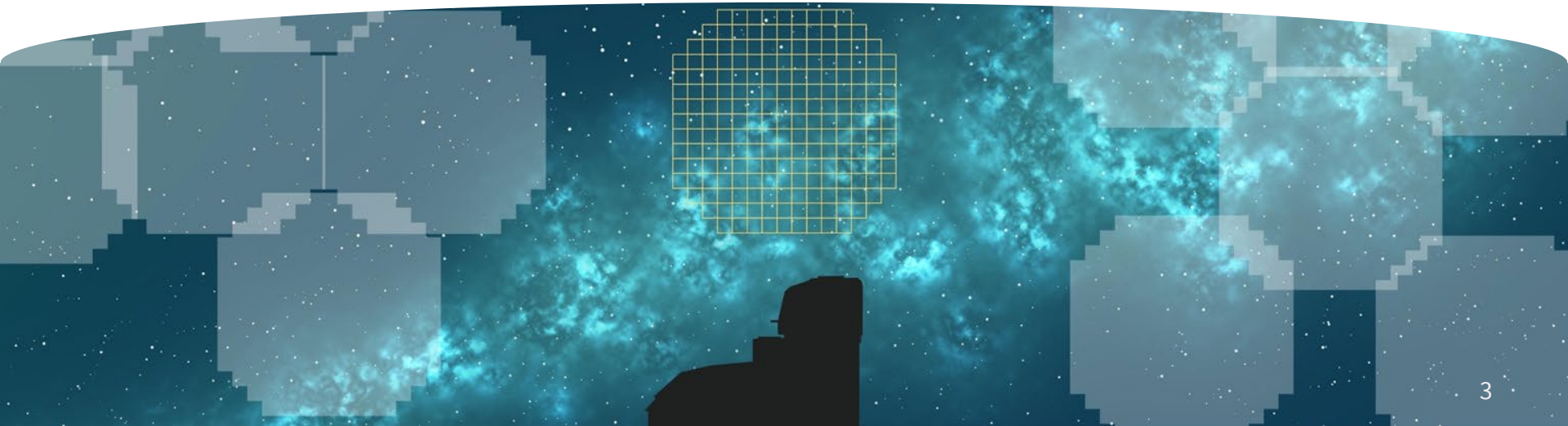
NOIRLab | AURA | SLAC NATIONAL ACCELERATOR LABORATORY

Rubin’s Legacy Survey of Space and Time (LSST)

Repeatedly scan the southern sky every ~3 nights for 10 years

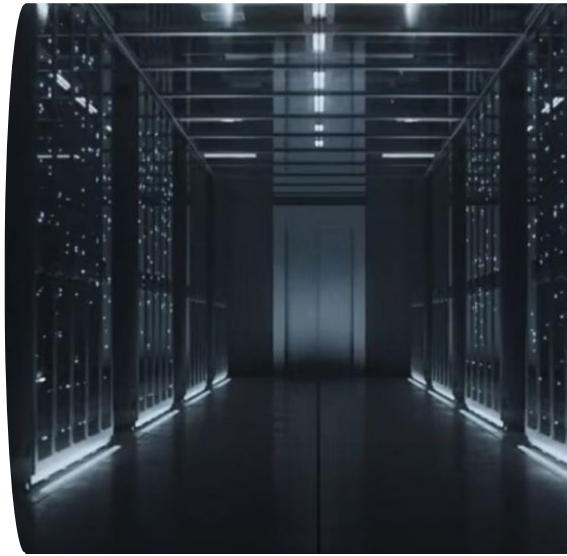
Wide-field survey conducted with a fast cadence in 6 color filters

LSST will build the most detailed time-lapse view of the cosmos ever generated



Cutting Edge Technology for a New Era

Olivier Bonin/SLAC National Accelerator Laboratory



LSST Camera

Largest digital camera ever (3200 Mpx)
6 filters, near-ultraviolet to near-infrared

Simonyi Survey Telescope

Novel three-mirror design = fast
Full-sky scan every 3-4 nights

Global Data Management System

20 TB/night transferred to US, France, UK
~10 million changes identified each night

Four Science Areas

Milky Way Structure & Formation

Rubin will help us make the best map of our home galaxy yet.

Solar System Census

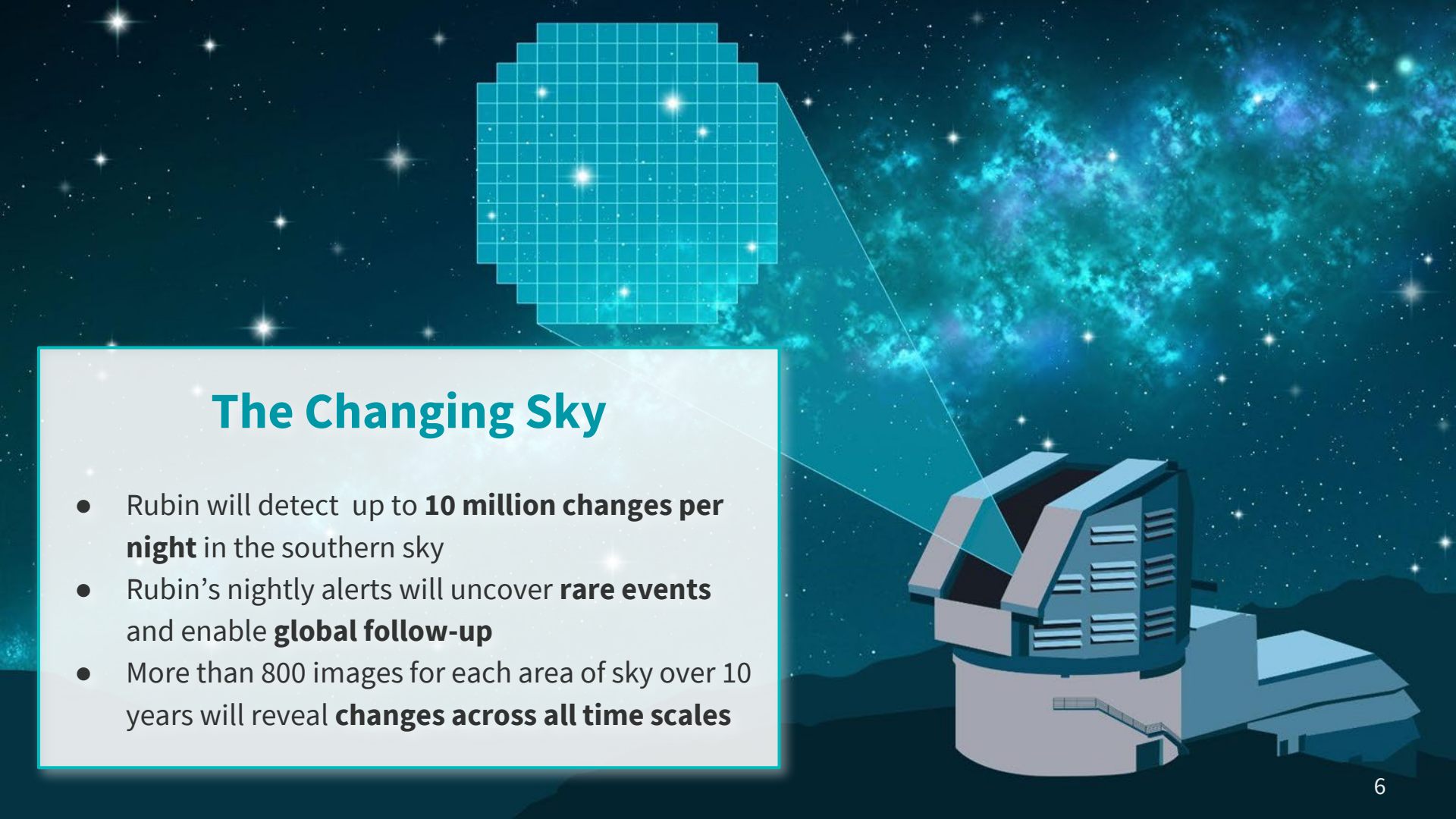
Rubin will show us millions of new asteroids and comets, and so much more.

Dark Matter & Dark Energy

Rubin is a brand new tool to help us learn more about their nature & behavior.

The Changing Sky

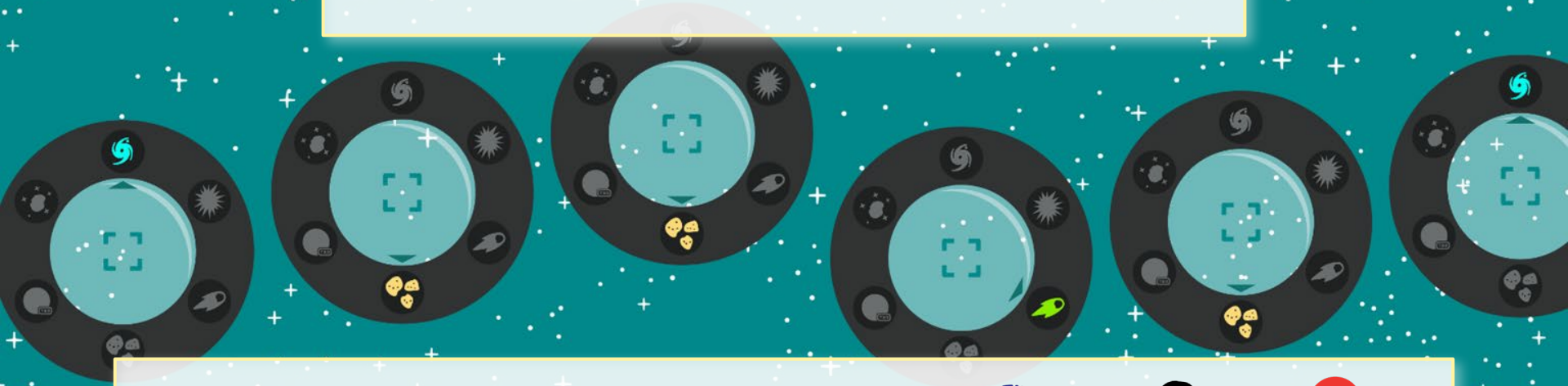
Rubin will bring the night sky to life, yielding a treasure trove of discoveries.



The Changing Sky

- Rubin will detect up to **10 million changes per night** in the southern sky
- Rubin's nightly alerts will uncover **rare events** and enable **global follow-up**
- More than 800 images for each area of sky over 10 years will reveal **changes across all time scales**

Navigating the Alert Stream



- Rubin uses **community brokers** — software systems that process & serve alerts to scientists
- Scientists access alerts via broker websites & can filter on their research area
- Alerts are **world public**

Alerce | Antares | AMPEL

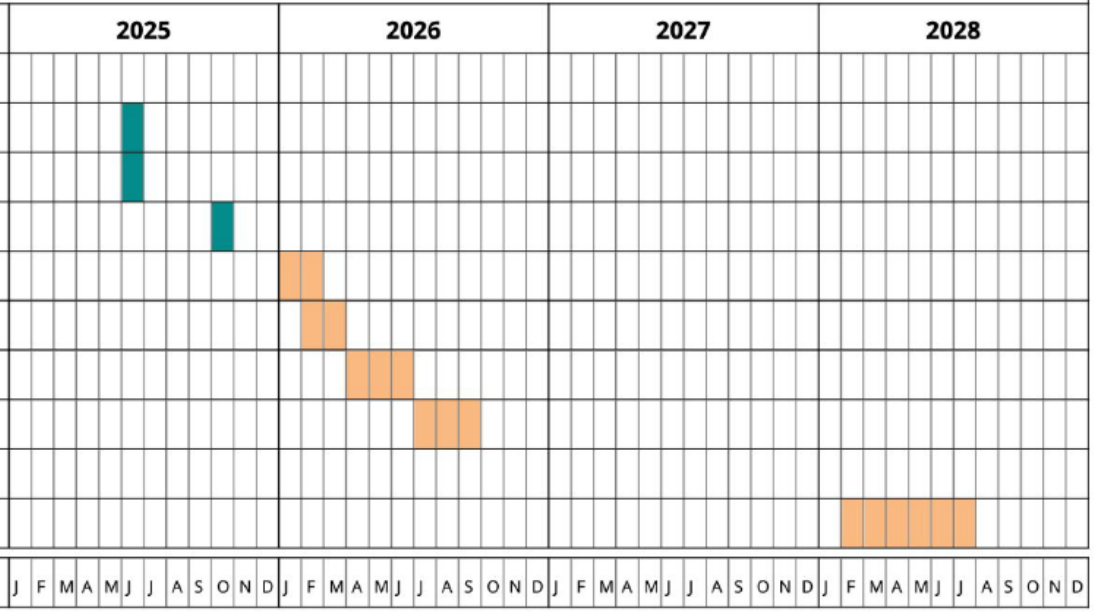
Fink | Lasair | Babamul

Pitt-Google Broker

Timeline for LSST

Rubin Operations Survey and Data Release Timeline

Event	Date Range
Data Preview 0.1/2/3 (DP0)	30 Jun 2023
Rubin First Light (RFL)	23 June 2025
Data Preview 1 (DP1)	30 Jun 2025
Start of Operations (OPS)	25 Oct 2025
Rubin First Alerts (RFA)	Jan – Feb 2026
Start of LSST (SVY)	Feb – Mar 2026
Nightly PVIs & Direct-Image Catalogs (NPC)	Apr – Jun 2026
Data Preview 2 (DP2)	Jul – Sep 2026
PPDB Release (PPDB)	Not before Jun 2026
Data Release 1 (DR1)	Feb – Jul 2028



Australia in LSST

- Annual data releases have a 2 year proprietary period, except for US- and Chile-based researchers, and “in-kind contribution” partners.
- AAL (through ADACS) offered:
  - 3 FTE for 10 years of professional software effort directable by Rubin Observatory.
  - a “Lite” Independent Data Access Centre with 576 CPU cores and 1.5 PB of storage.
- Rubin offered 47 PIs, with up to 4 Junior Associates each.
- Funded in 2024–2027 by a $1.3M ARC LIEF grant + NCRIS funds + partner contributions.
- 15 Chief Investigators + 32 named associates from 15 partner institutions on LIEF grant fill these PI roles.

Implications for radio astronomy I

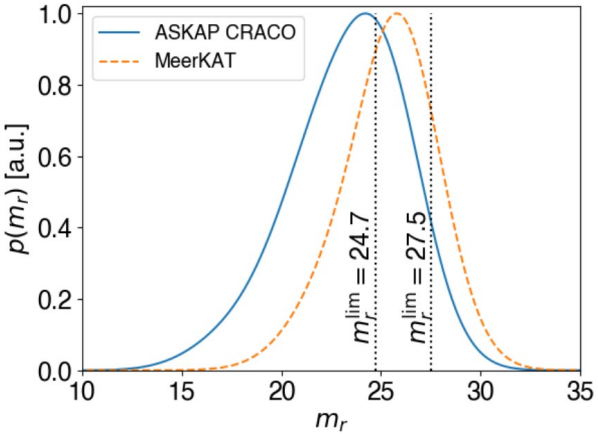
- Pre-LSST, more than half of ATCA time requests are for NAPAs.
- Rubin alerts will only push this fraction higher.
- The current ATCA model of “classically scheduled” observers being overridden by NAPAs is not sustainable.
- BIGCAT now makes it possible to move to a dynamically-scheduled autonomous observing mode (as for ASKAP).

Implications for radio astronomy II

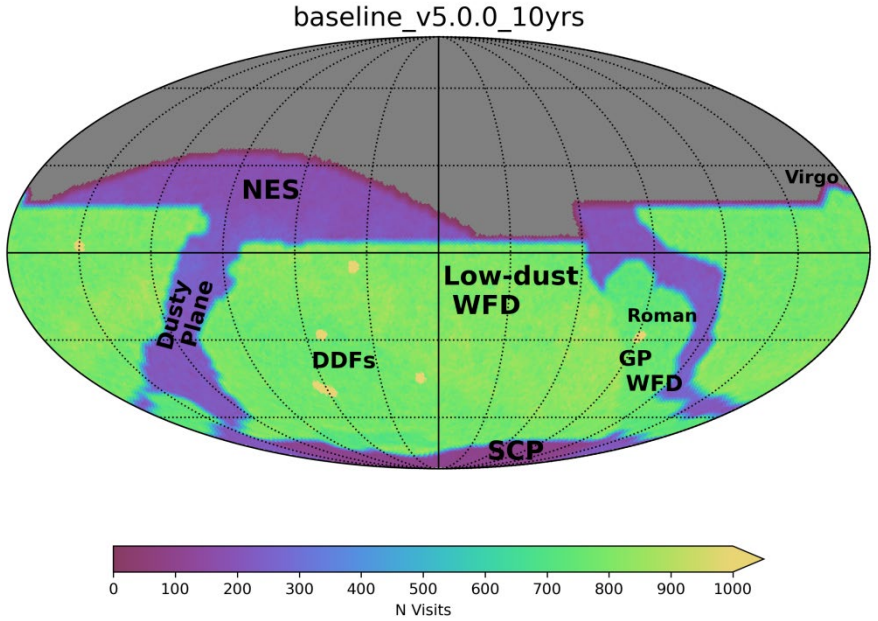
- Rubin will publish a nightly schedule at least 24 hours in advance, followed by updated schedule published ~2 hours before each visit, via an IVOA Observation Locator TAP.
- Potential for Australian radio facilities to “shadow” Rubin, similar to the way the Deeper, Wider, Faster program (Cooke et al.) shadowed DECam on the Blanco 4m.

Implications for radio astronomy III

- Traditional deep imaging follow-up of interesting radio sources with optical telescopes will soon become unnecessary.
- Limiting magnitudes (5σ) of:
  - m_r = 24.7 (single 30 sec visit)
  - m_r = 27.5 (10 yr co-adds)

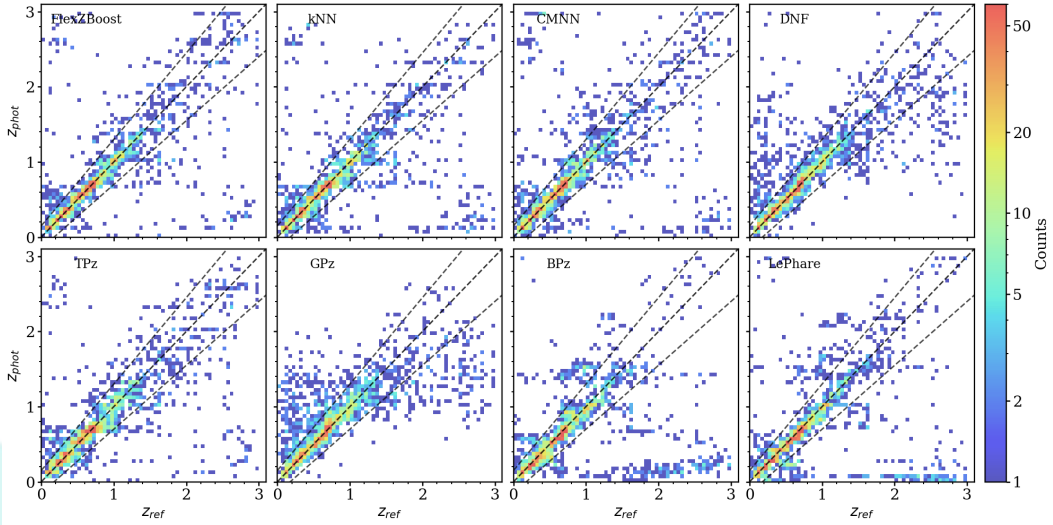


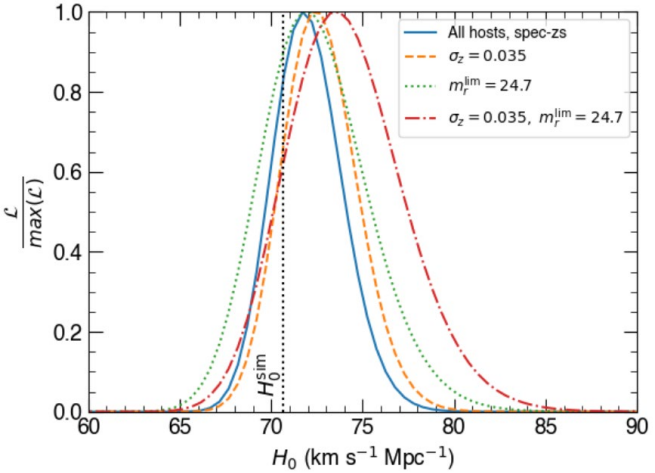
courtesy Clancy James (ICRAR Curtin)



Implications for radio astronomy IV

- Traditional spectroscopic redshift measurements for extragalactic radio sources with optical telescopes will also become unnecessary.
- With 6 bands, ML photo-z's good to <0.05.





courtesy Clancy James (ICRAR Curtin)

In summary

- Just as ASKAP and MWA have revolutionized how we do radio astronomy, so too will Rubin Observatory's LSST in optical astronomy.
- It's never too early/late to get started with Rubin data – sign up to become a JA today!