

Vera Rubin Observatory: Overview and Project Status Update

Igor Andreoni

TDAMM, Huntsville, AL
October 27, 2025



THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL

Rubin Transients and Variable Stars
science collaboration



Vera C. Rubin Observatory



Vera Rubin provided conclusive evidence for the existence of Dark Matter

Advocate for women in STEM

project.lsst.org/documents/name-use-guide

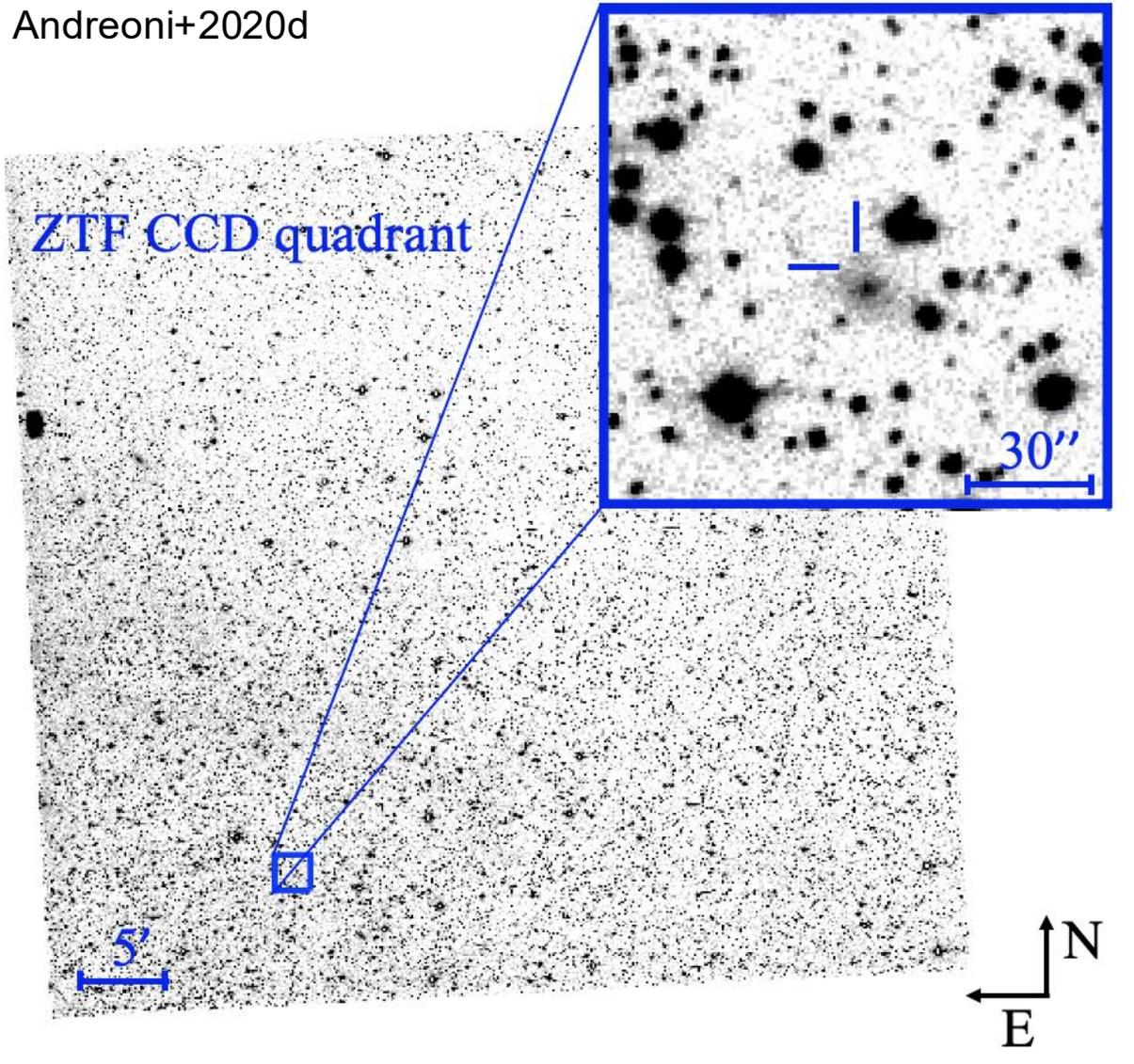


Vera C. Rubin Observatory

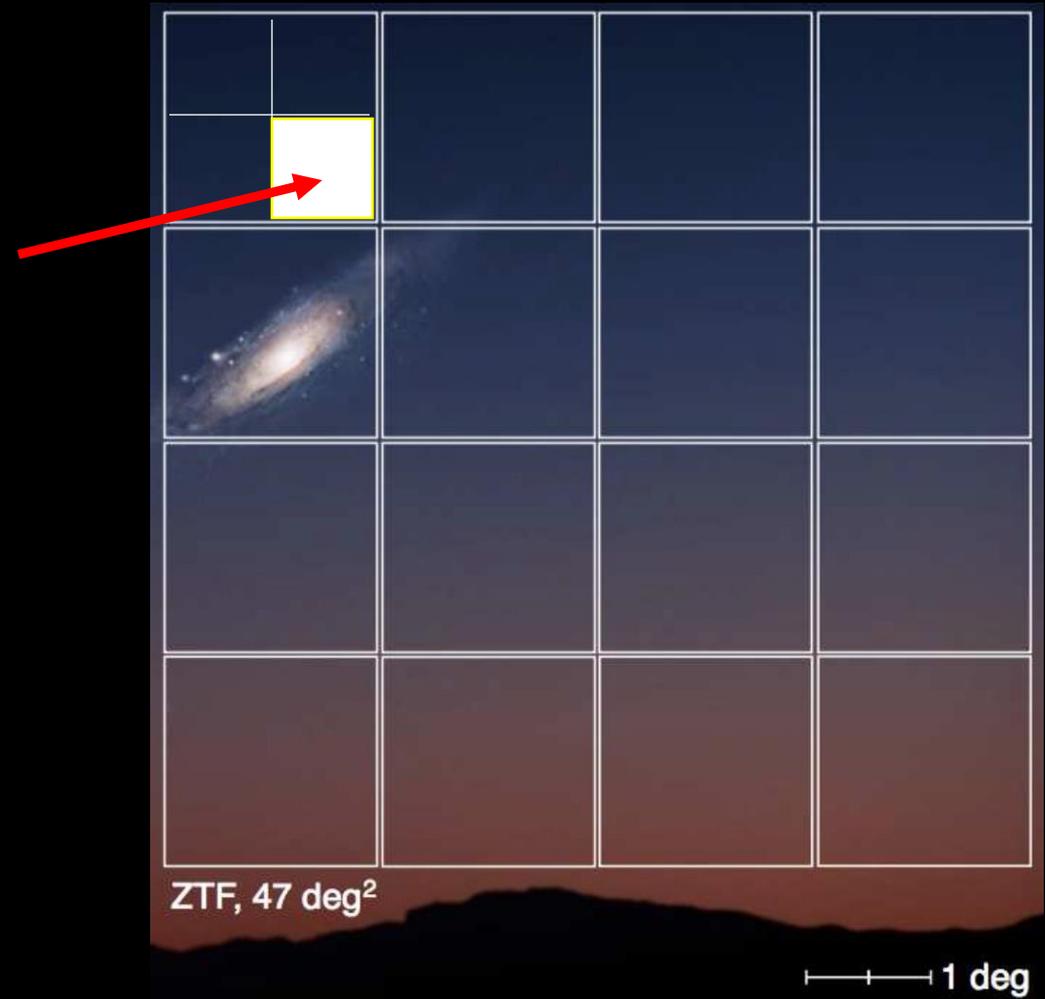


A big data context

Andreoni+2020d

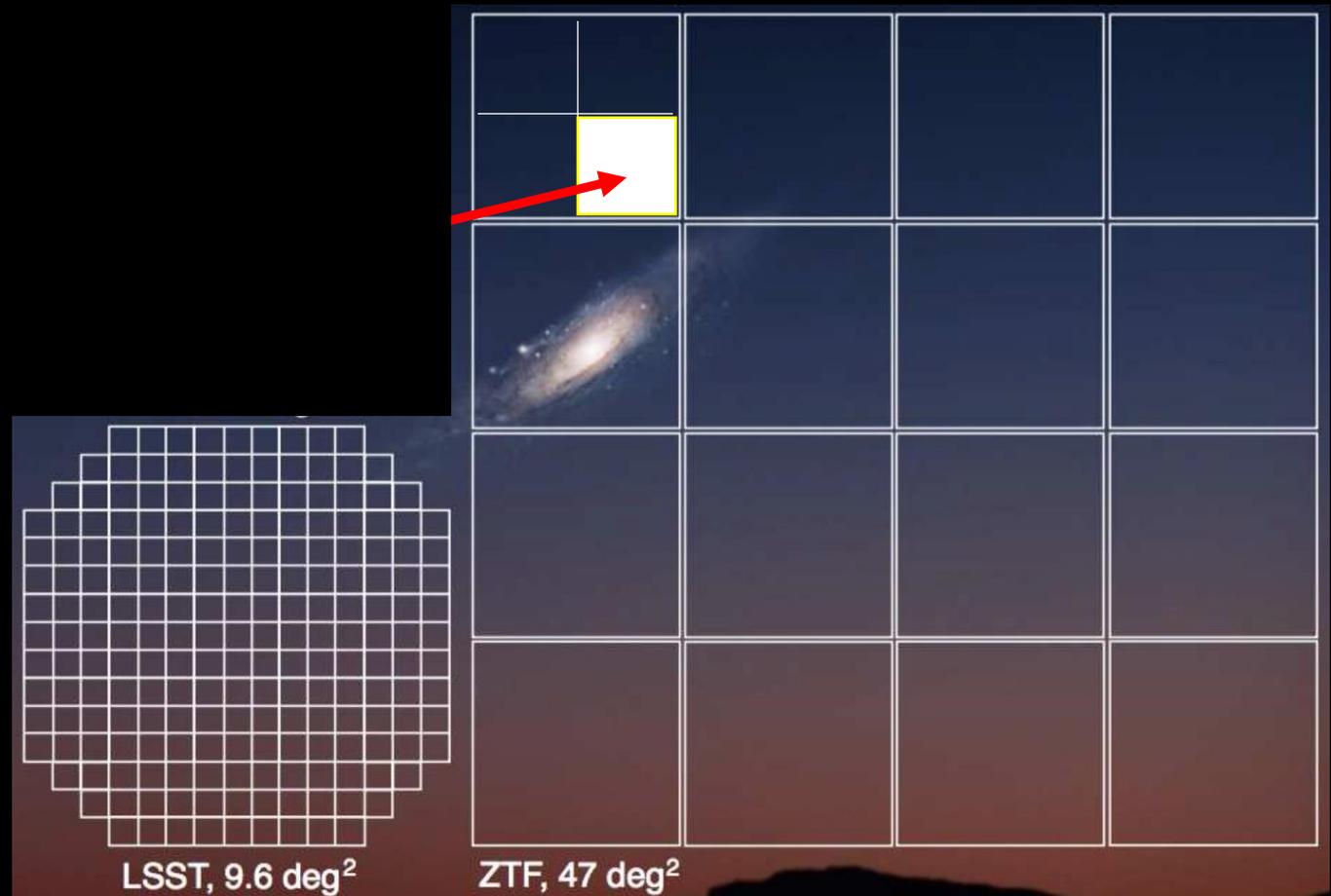


A big data context



A big data context

Zwicky Transient Facility $r < 20.5$ mag



Rubin $r < 24.03$ mag in 30s exposure

1 deg



The Sphere



57.6 Mpx

Igor Andreoni

Rubin Observatory at a glance



LSSTCam 3.2 GigaPixel

9.6 deg² field of view

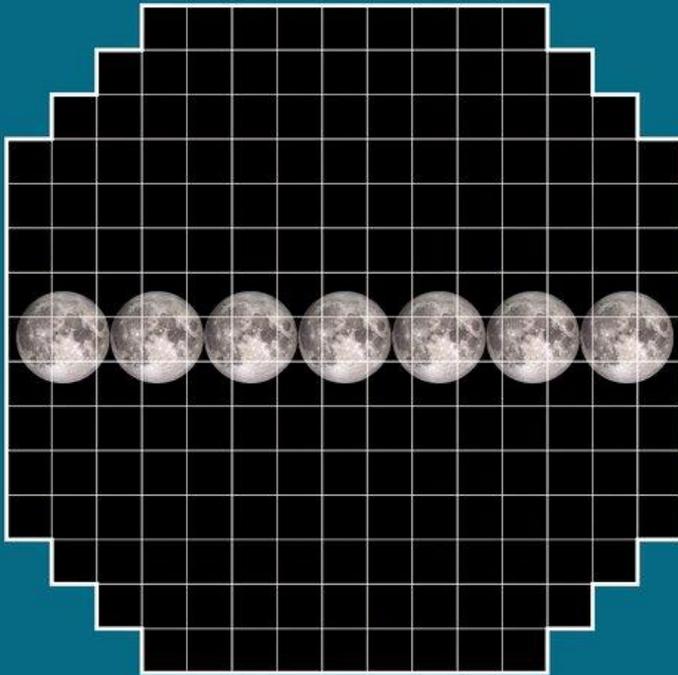
u-g-r-i-z-y filters

0.2 arcsec/pixel

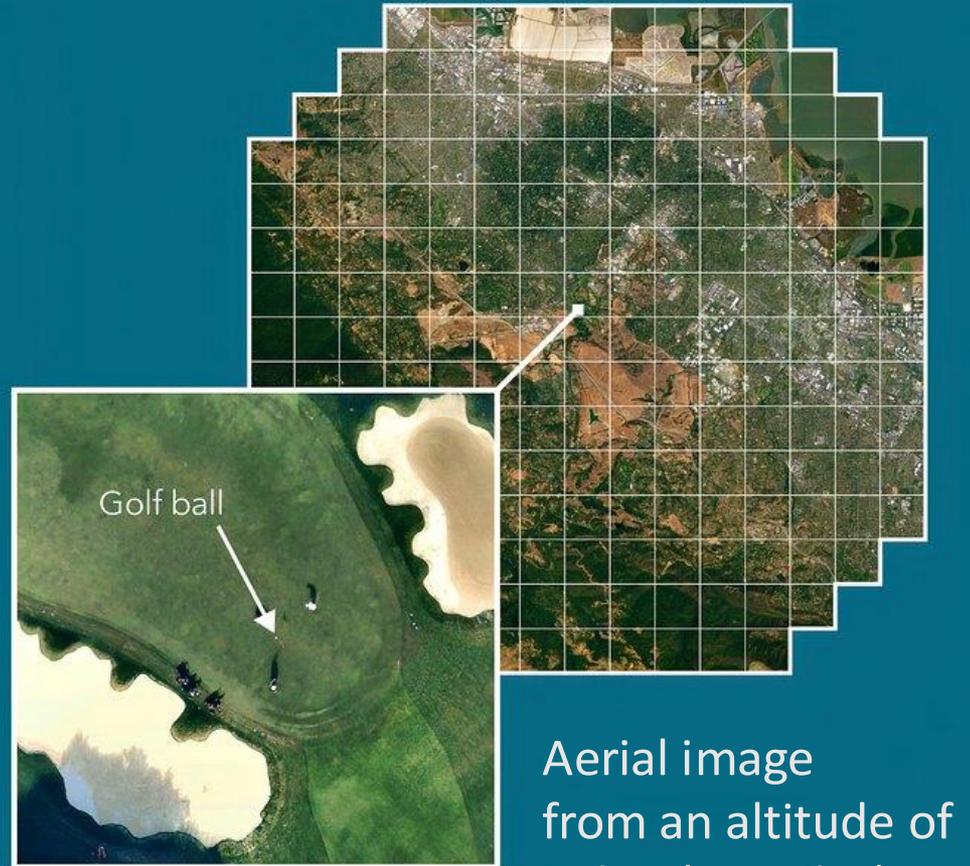


Field of view + depth + resolution

Field of View



Resolution



Aerial image
from an altitude of
24km (15 miles)

Credit: Stewart



LSST: from “Large Synoptic Survey Telescope” to “Legacy Survey of Space and Time”

Four Science Areas

Milky Way Structure & Formation

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



Dark Matter & Dark Energy

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



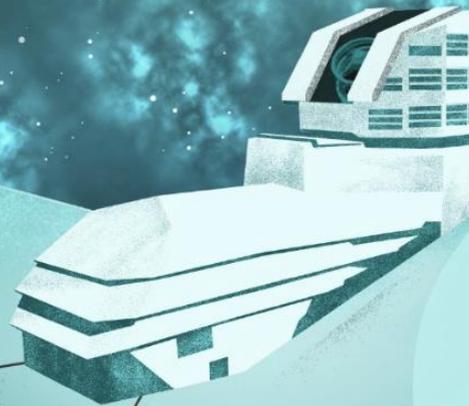
Solar System Census

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



The Changing Sky

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



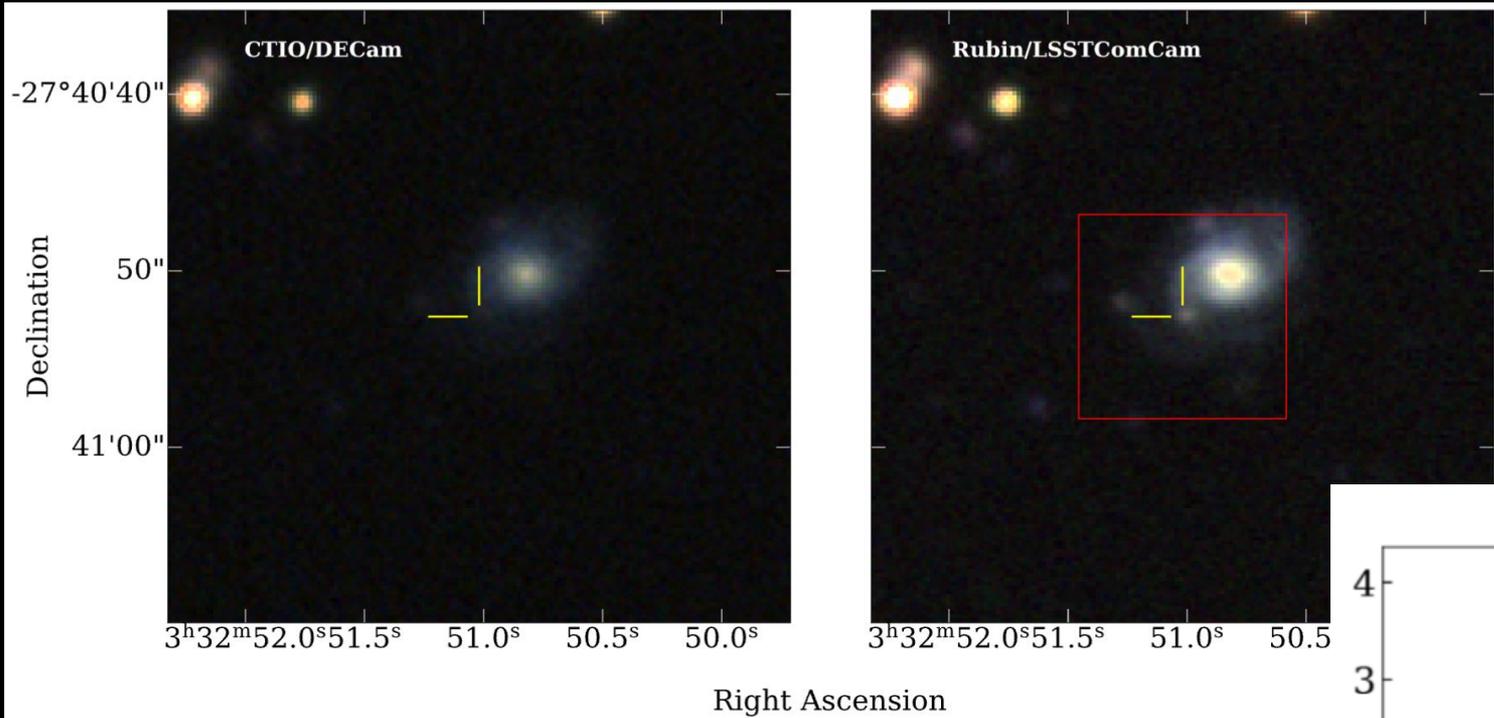
The changing sky



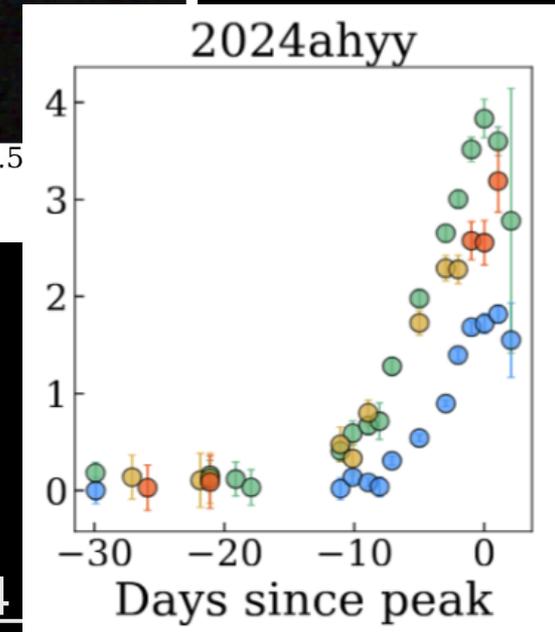
- Rubin will detect up to **10 million changes per night** (“**alerts**”) in the southern sky
- Rubin’s nightly alerts will uncover **rare events** and enable global follow-up via **real-time data processing (< 60s)**
- More than 800 images for each area of sky over 10 years will reveal **changes across multiple time scales**



Transient detection in Rubin is happening!



Searches in three DP1 fields
11 supernova candidates found
3 already known, 8 newly identified



Freeburn, IA et al., ApJL under review [arXiv:2507.22864](https://arxiv.org/abs/2507.22864)

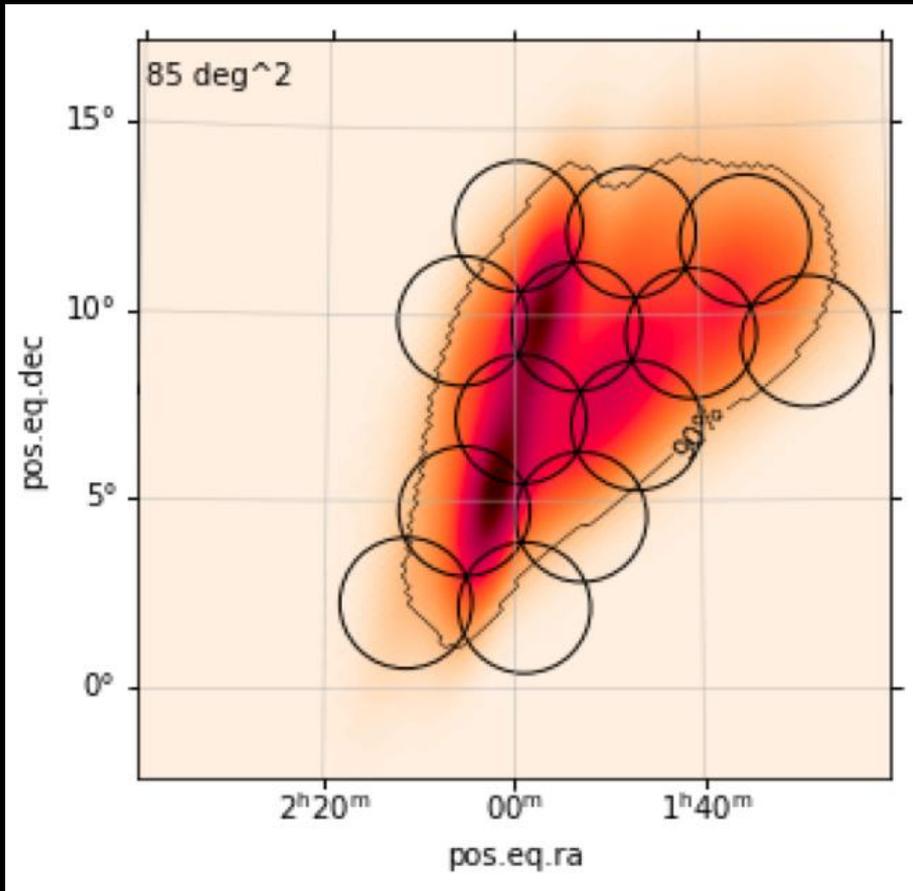


The Rubin Target of Opportunity program

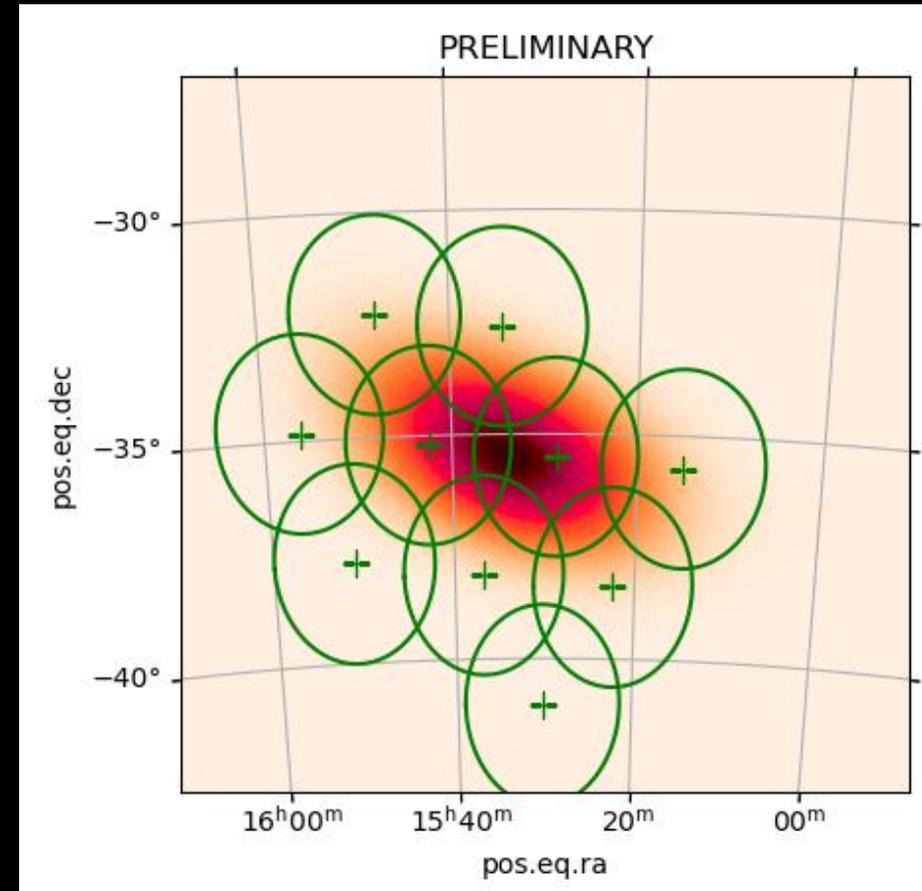
A Key Follow-up Facility

- Rubin will also operate in “**Target of Opportunity**” mode
- It will be **the** best facility in the world for follow-up of **high-energy neutrino and gravitational wave events**

The Rubin Target of Opportunity program



IA et al. (2022b)



July 29, 2025

Binary black hole merger S250725j

Credit: MacBride



Milky Way Structure and Formation

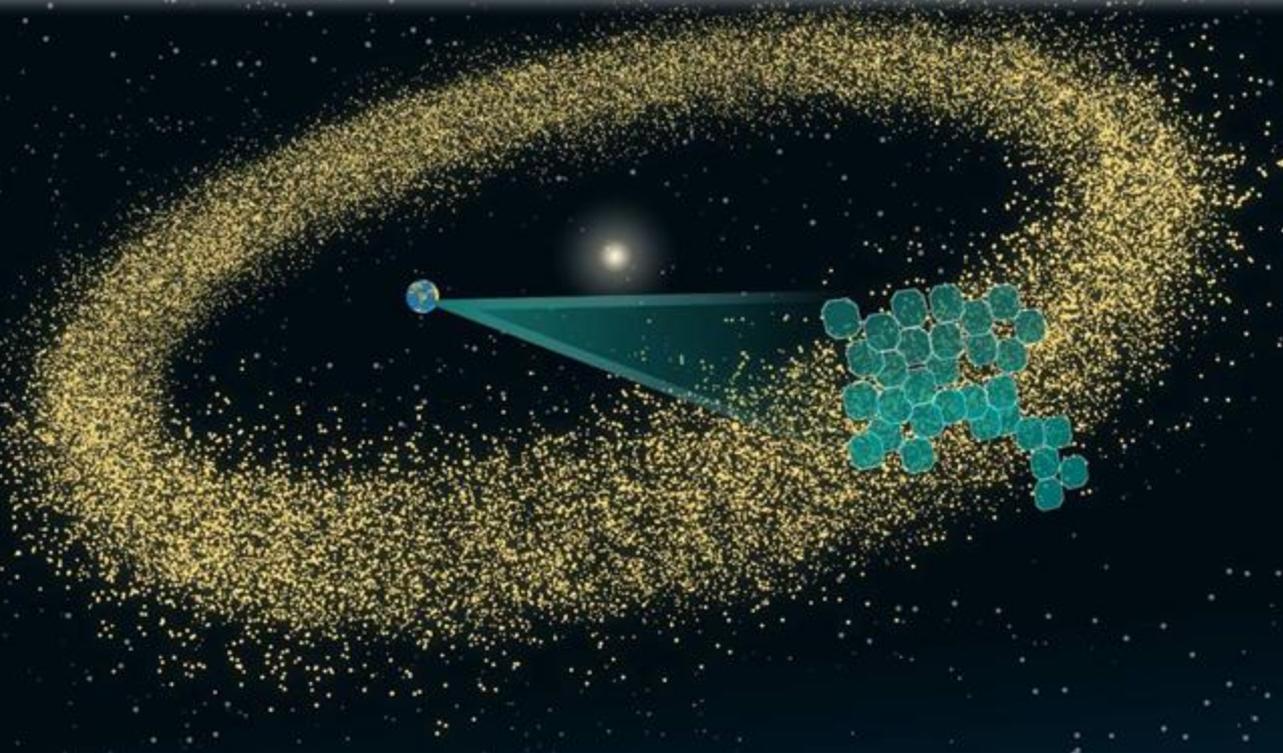
RubinObs/NOIRLab/NSF/AURA/J. daSilva, M. Zamani

- Rubin's 10-year dataset will catalog Milky Way stars in unprecedented detail in 6 bands and < 0.4 arcsec FWHM resolution
- Stellar variability
- Creates a 3D map **~100x larger** than previous surveys, with data on **billions of star**



Census of the Solar System

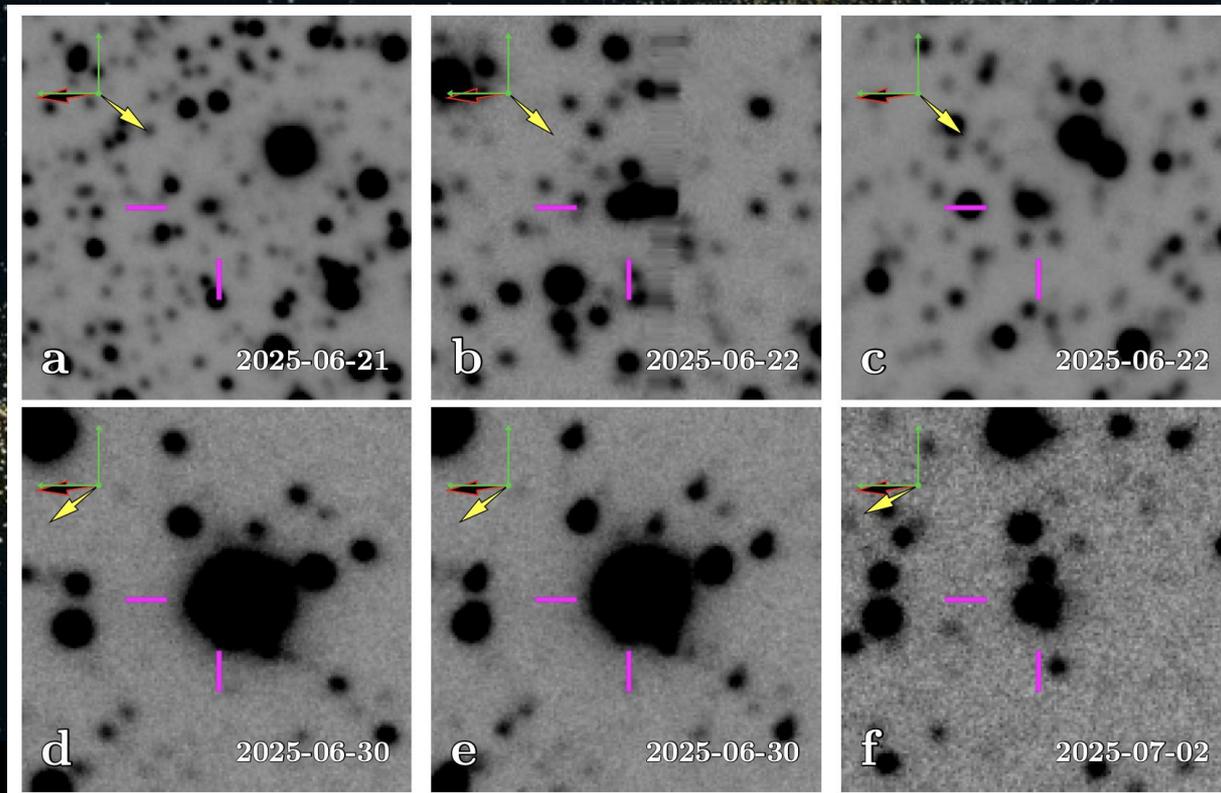
- Rubin will uncover **millions of new Solar System objects**
- Rubin's asteroid-detection capability is a **game-changer for planetary defense**
- Studying our Solar System reveals key insights into how **other planetary systems** form
- Planetary **defense**



3I/ATLAS

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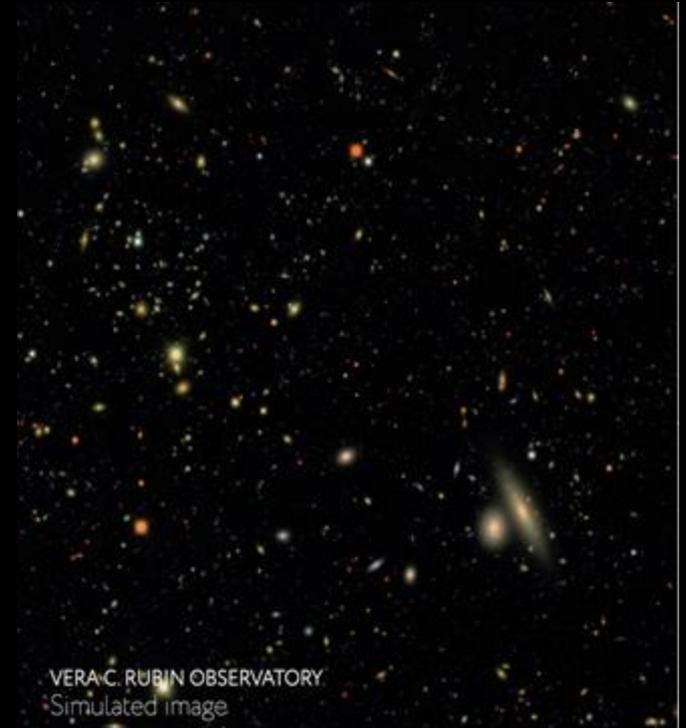
modified from
Chandler+2025



Uncovering the unexpected

- Unknown classes of objects
- New transients
- Phenomena that challenge existing theories
- ...and more!

Every time we look at the Universe in a new way, we make discoveries we never could have predicted. And **now we will see more than we ever have before**



Processing: LSST DESC; Image: J. Chiang/SLAC, C. Hirata/Ohio State University and NASA's Goddard Space Flight Center

LSST survey cadence optimization committee (SCOC)



Committee Members:

Timo Anguita, Universidad Andres Bello, Chile

Roberto Assef, Universidad Diego Portales, Chile

Eric Bellm, University of Washington, USA

Sylvie Dagoret-Campagne, University of Paris-Sud, Orsay, IN2P3, France

Louise Olivia Violet Edwards, Cal Poly, SLO, USA

Saurabh Jha, Rutgers University, USA

Rachel Mandelbaum, CMU, USA

Adam Miller, Northwestern University, USA

Stephen Smartt, Oxford University, USA

Rachel Street, Las Cubres Observatory, USA

Kathy Vivas, Noirlab, USA

Kat Volk, Planetary Science Institute, USA

Non-voting Committee Members:

Lynne Jones, Rubin Observatory, ex officio

Federica Bianco, Rubin Observatory, Chair (ISSC liaison)

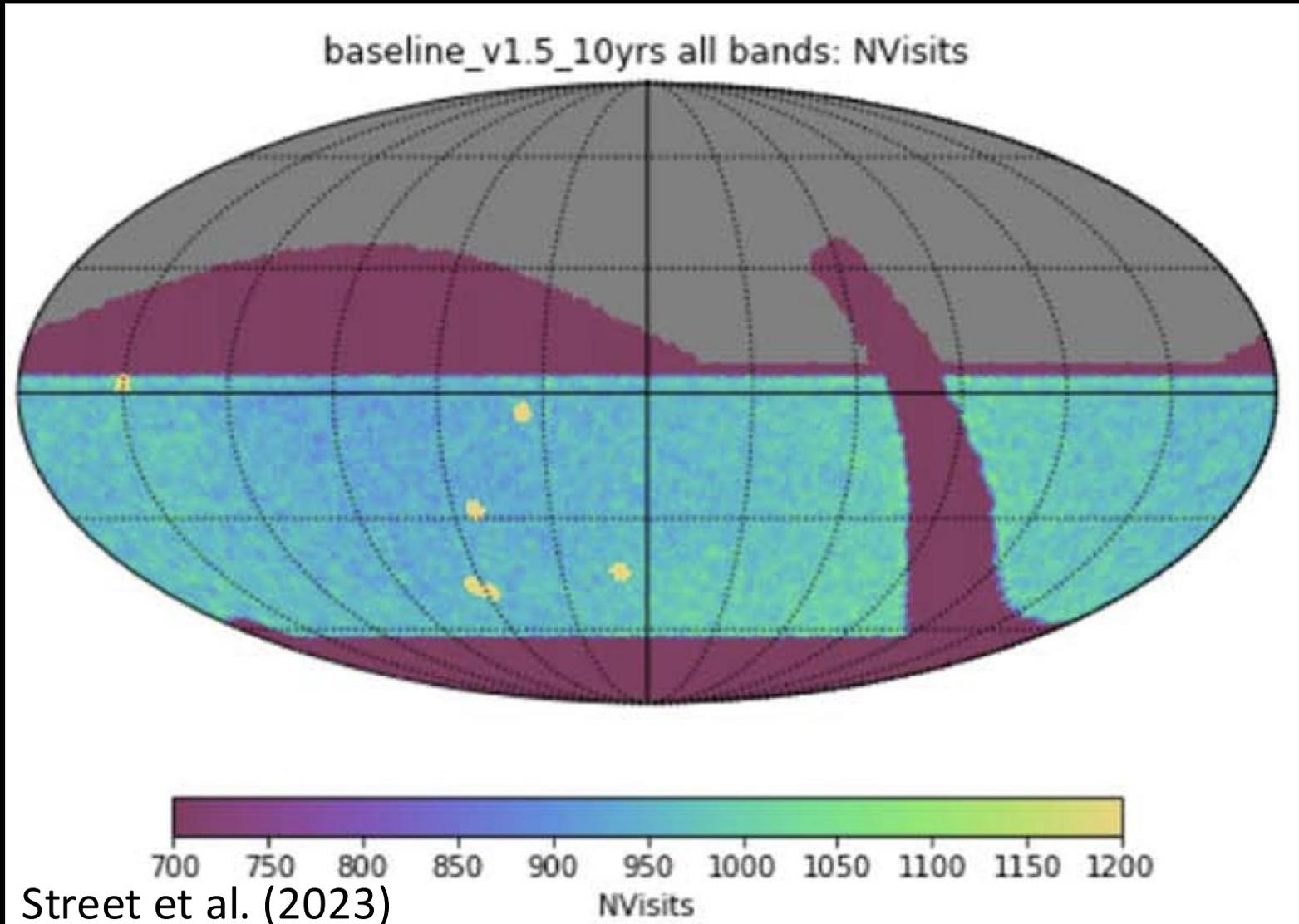
With many thanks to the recent outgoing members!

Franz Baur, Knut Olsen, Colin Slater, Jay Strader

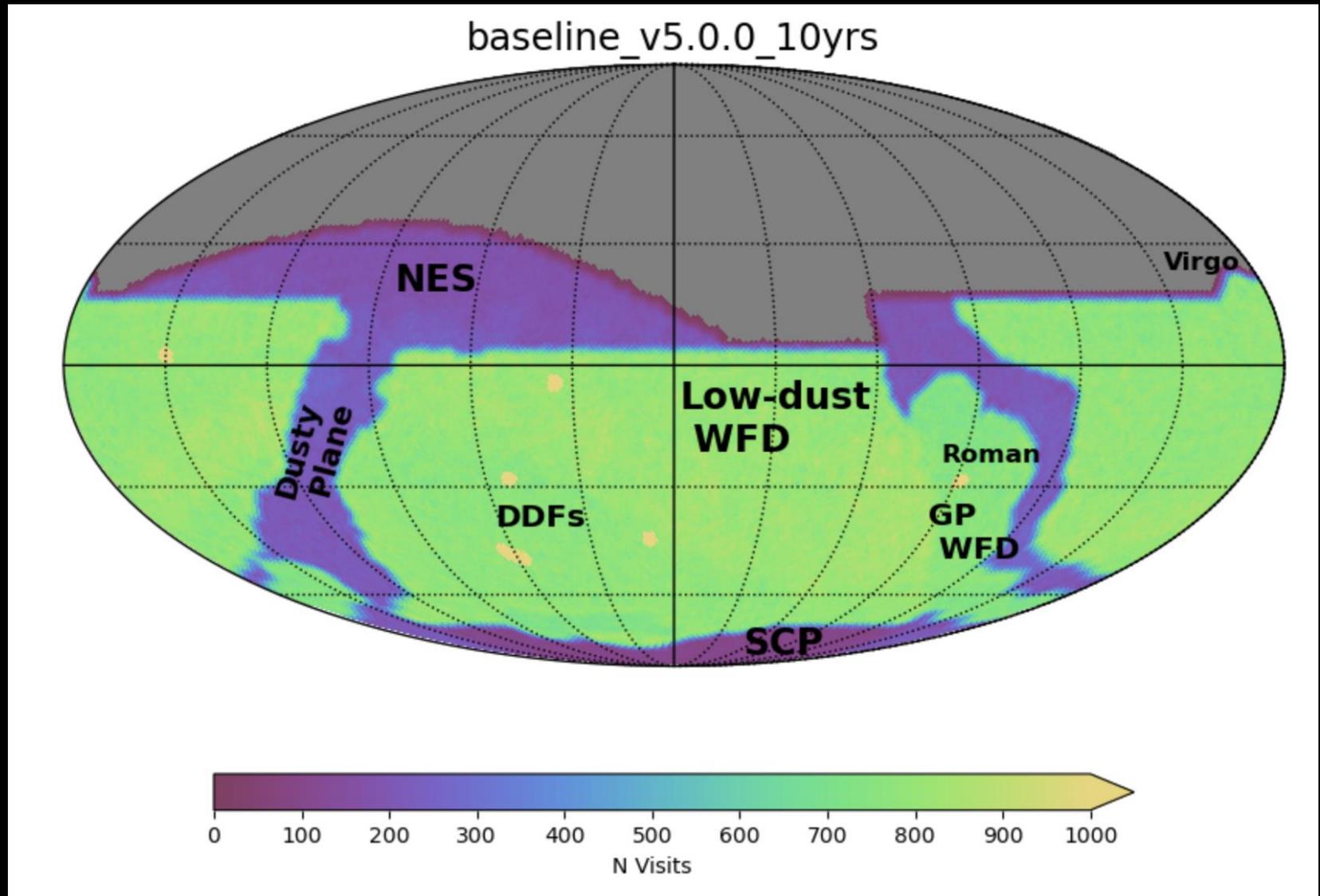
And earlier members: Sarah Brough, Renee Hlozek, Mansi Kasliwal,

Hiranya Peiris, Dan Scolnic, Meg Schwamb

LSST survey initial baseline strategy

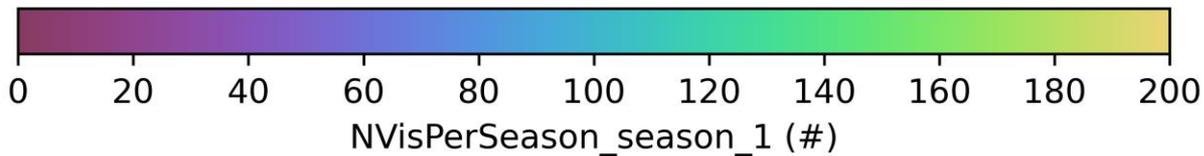
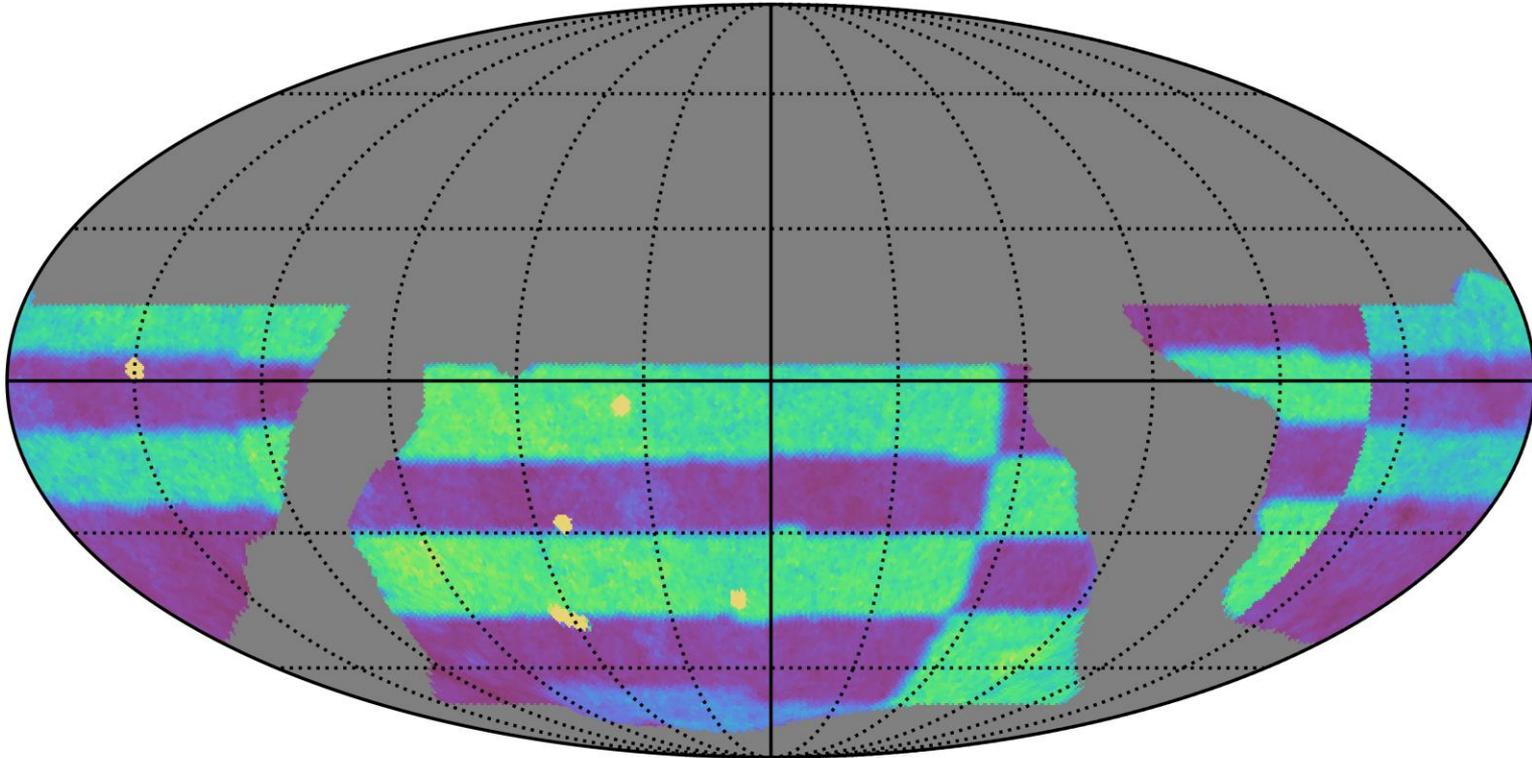


LSST survey strategy optimization



WFD: Rolling Cadence

baseline_v5.0.0_10yrs : NVisPerSeason_season_1



Deep Drilling Fields

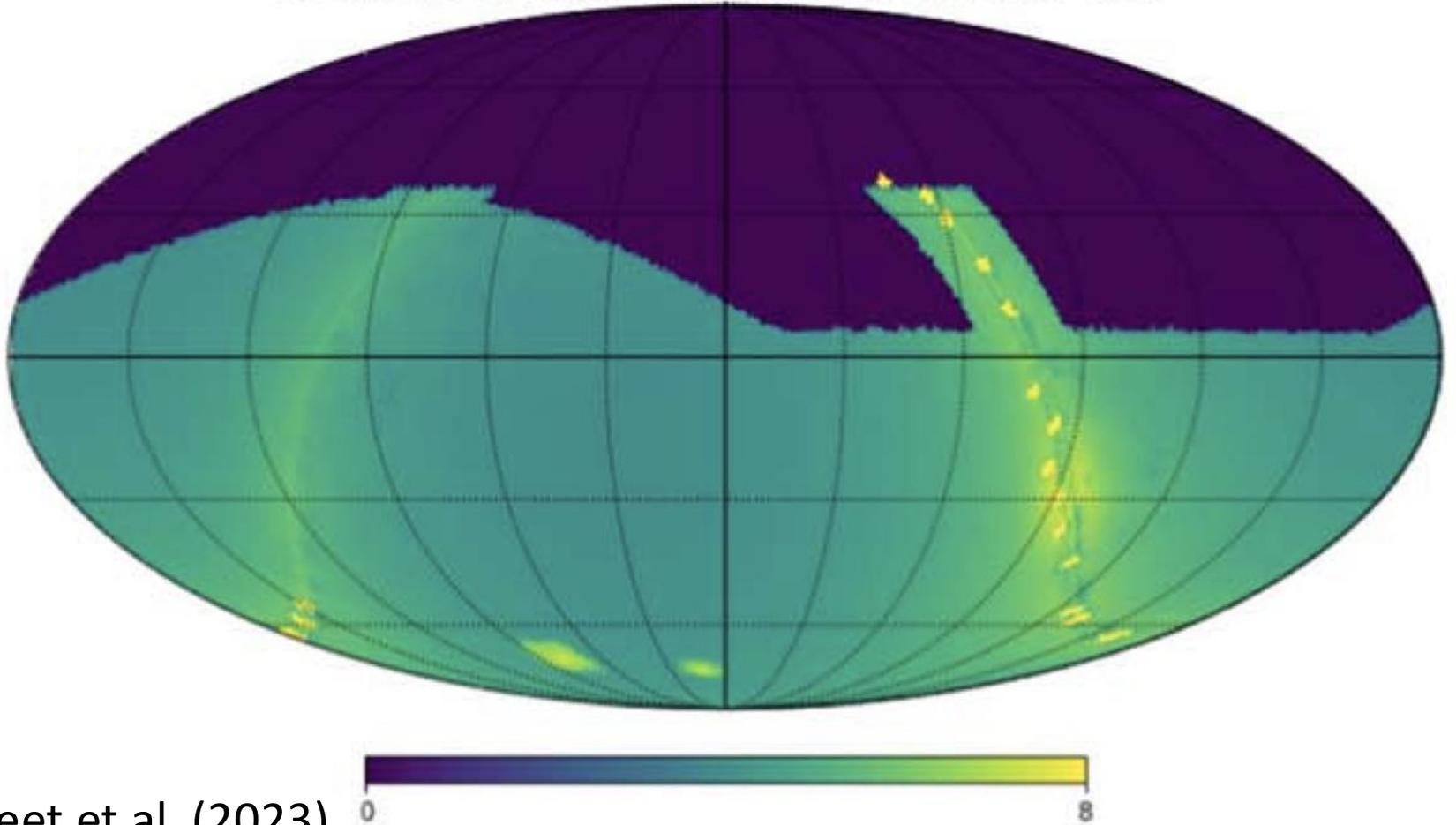
| | ELAISS1 | XMM_LSS | ECDFS | COSMOS | EDFS_a | EDFS_b |
|---------|---------|---------|--------|--------|--------|--------|
| RA | 9.45 | 35.57 | 52.98 | 150.11 | 58.9 | 63.6 |
| Dec | -44.02 | -4.82 | -28.12 | 2.23 | -49.32 | -47.6 |
| Gal l | 311.29 | 171.1 | 224.07 | 236.78 | 257.9 | 254.48 |
| Gal b | -72.88 | -58.91 | -54.6 | 42.13 | -48.46 | -45.77 |
| Eclip l | 346.66 | 31.59 | 40.81 | 151.39 | 32 | 40.97 |
| Eclip b | -43.2 | -17.92 | -45.44 | -9.34 | -66.61 | -66.6 |

20,000 visits each
~40,000 for COSMOS



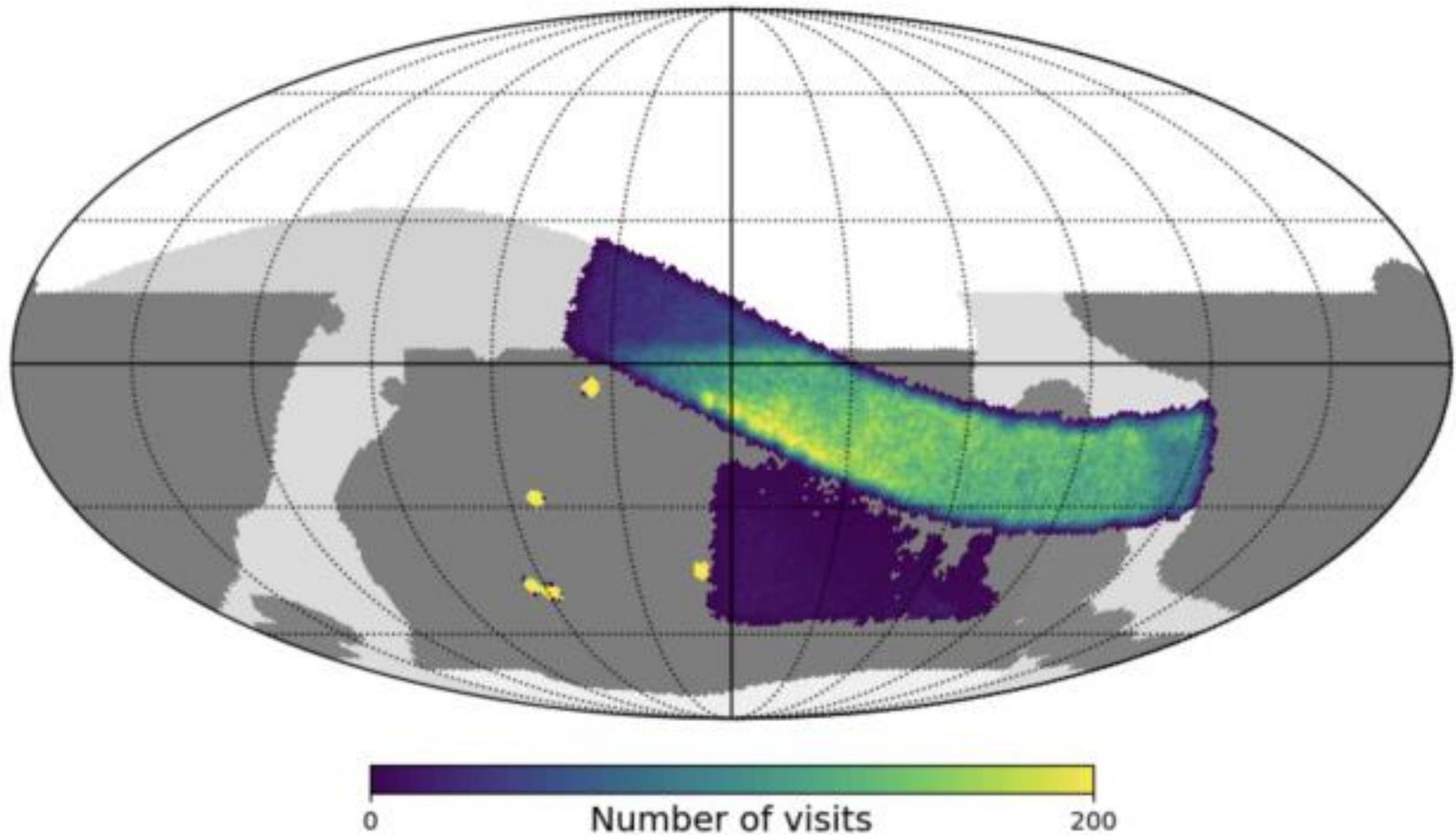
Galactic Plane

Optimized pencilbeam survey regions in the Galactic Plane

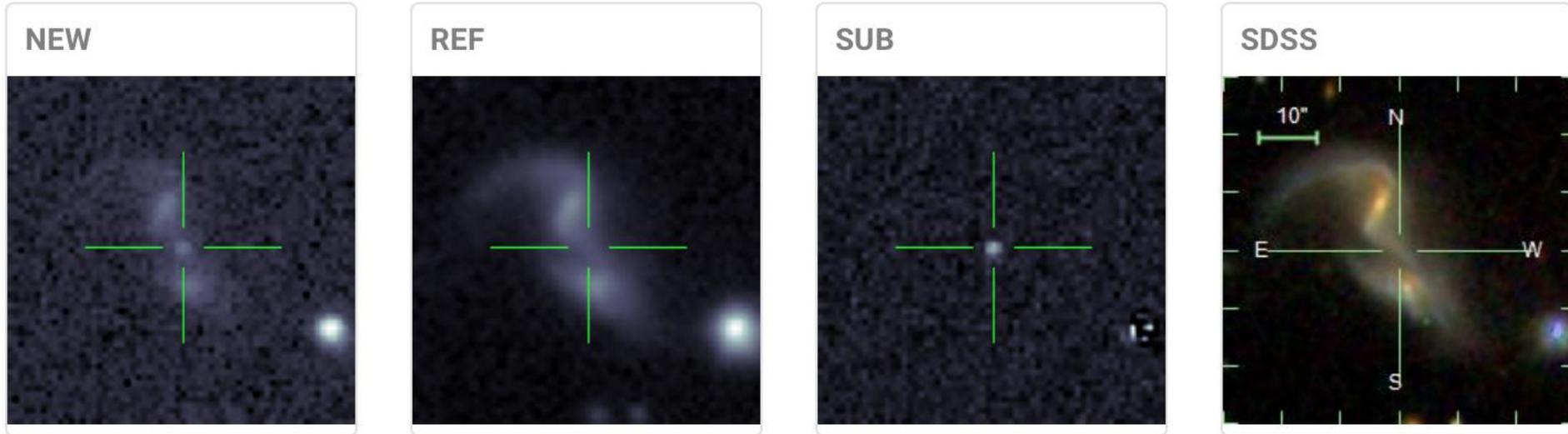


Street et al. (2023)

Science Verification Survey & Timeline



Data access: alerts



ZTF generates **~300,000** Alerts per night
Rubin Observatory will generate up to **10 million** alerts per night
Rubin alerts will be public



Data access: Science Platform, Notebooks, APIs

Rubin Science Platform

Portal

Discover data in the browser



[Learn more about the portal.](#)

Notebooks

Process and analyze LSST data with
Jupyter notebooks in the cloud



[Learn more about notebooks.](#)

APIs

Learn how to programatically access
data with Virtual Observatory interfaces



* These can be accessed only by data-rights holders













Thank you!

