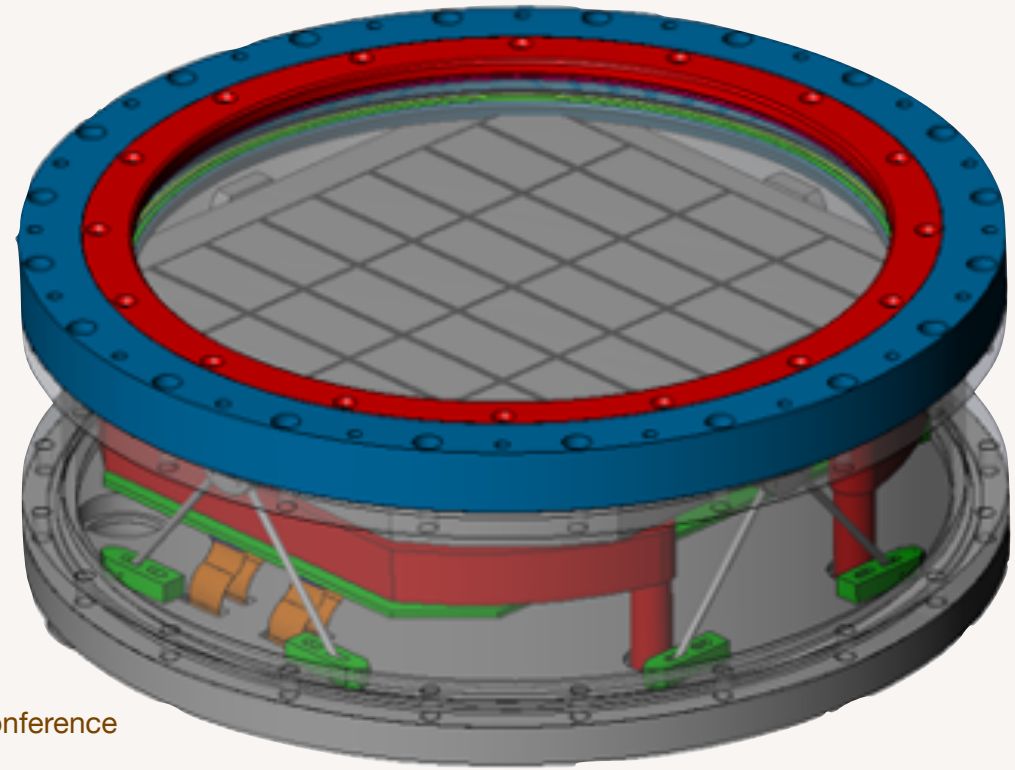
La Silla Southern Sky Survey
(LS4)



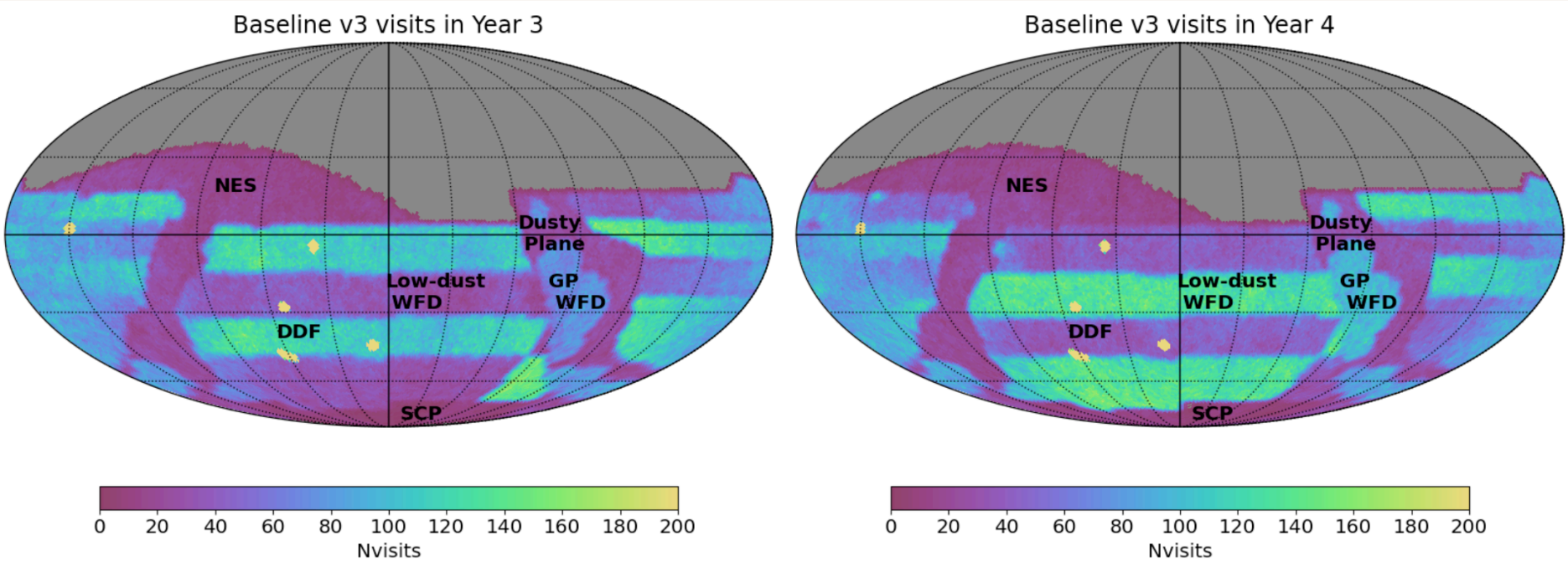
Adam A Miller
Northwestern/CIERA

Transient and Variable Universe Conference
20 June 2023

Why?

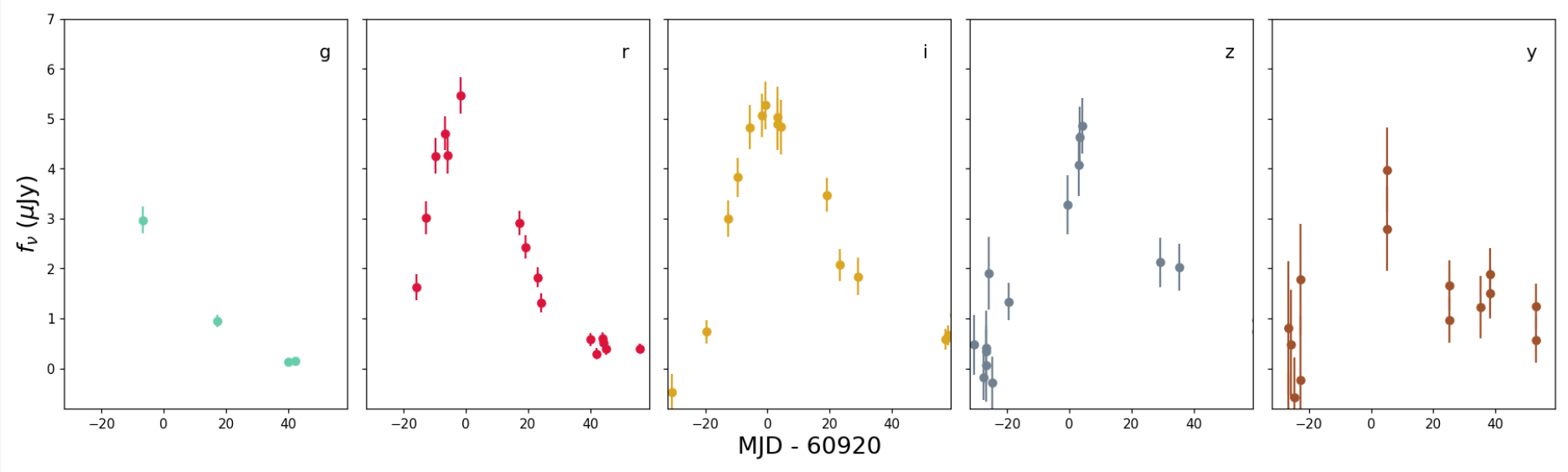
Rubin

Rolling Cadence



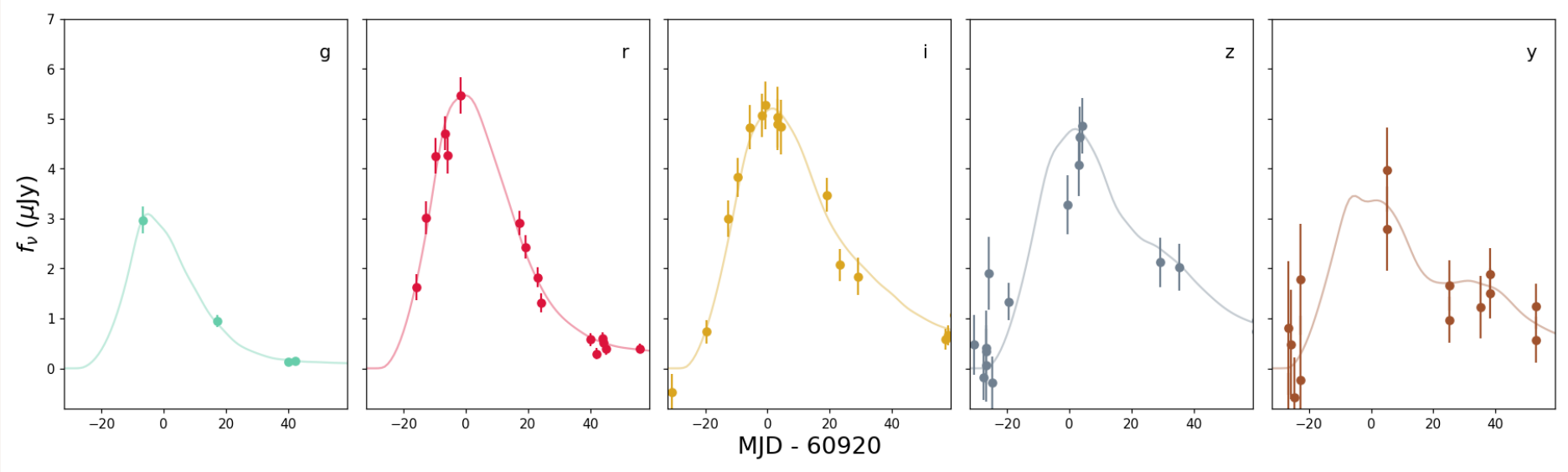
Rubin

Rolling Cadence



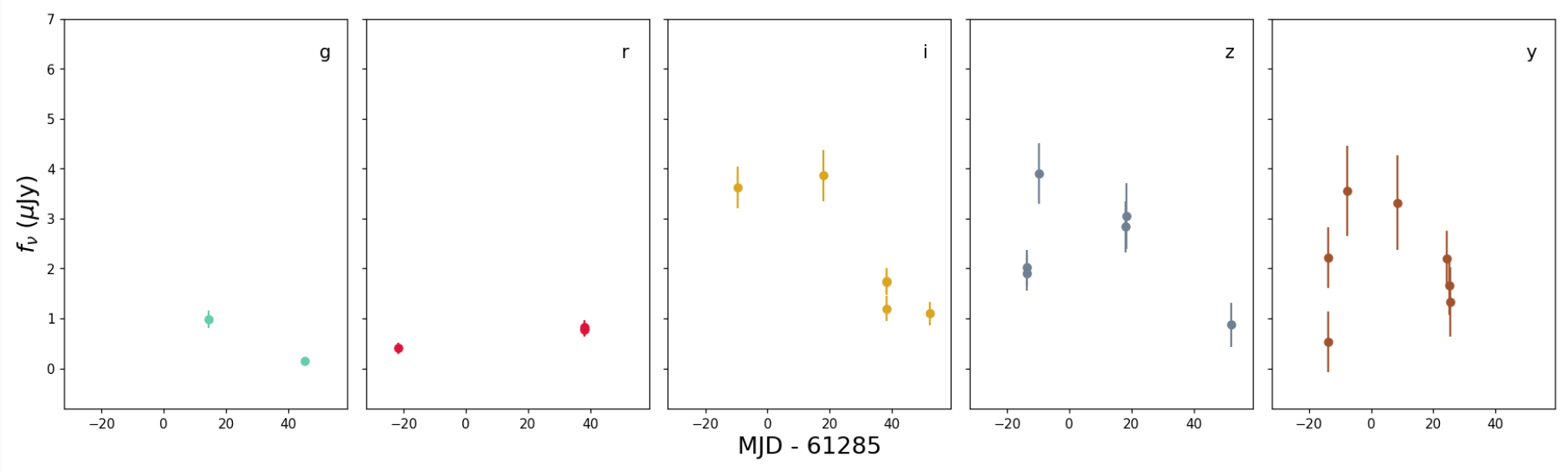
Rubin

Rolling Cadence



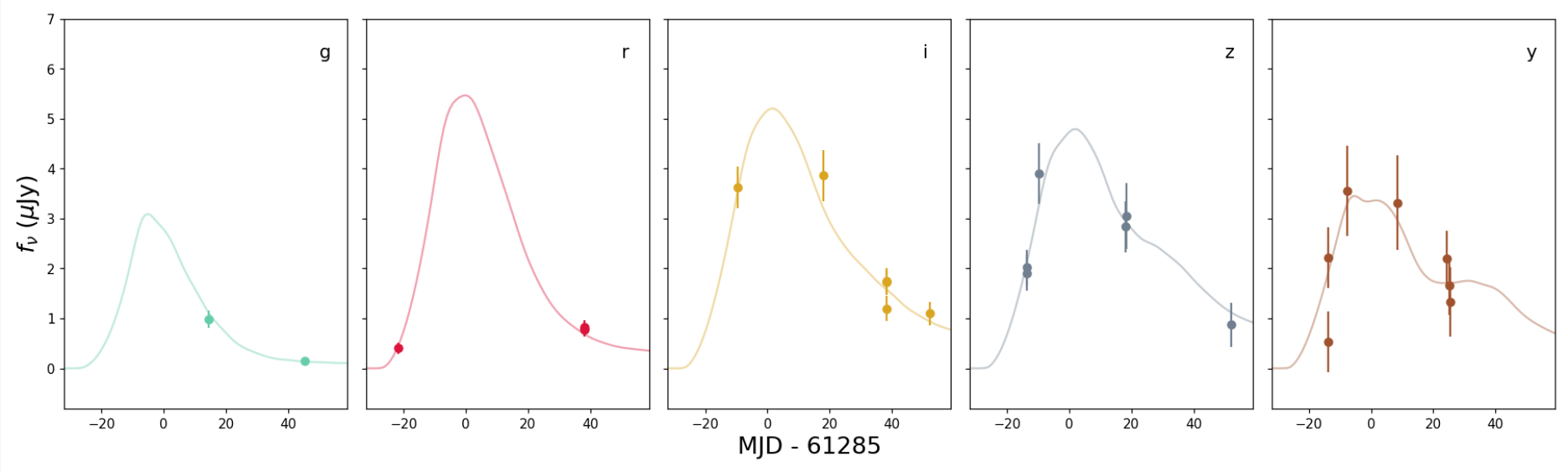
Rubin

Rolling Cadence



Rubin

Rolling Cadence



How?

(re)Use existing resources

ESO 1m Schmidt telescope

QUEST camera (retrofit to fill 20 deg^2 focal plane)

32 LBNL CCDs (leftover from DES)

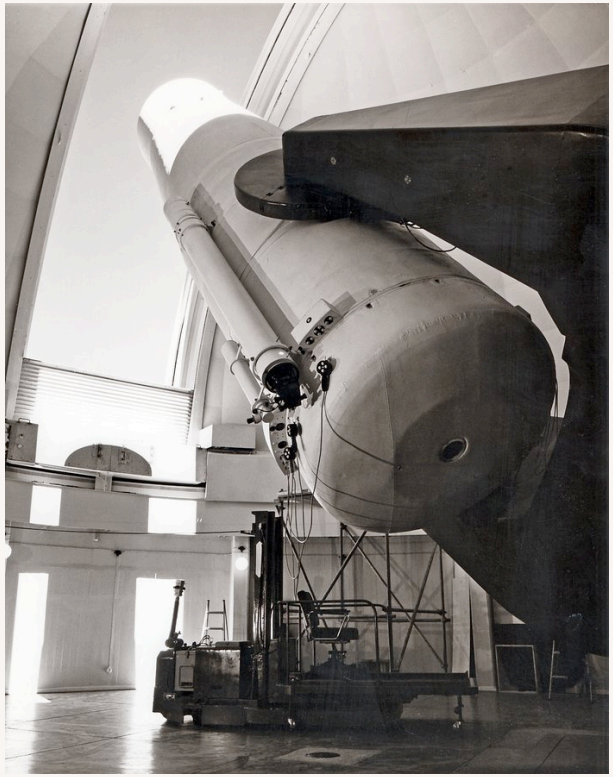


image credit: ESO

LS4 Partnership

Responsible for camera & survey

Bar-Ilan University

Fermilab National Accelerator Laboratory

Lawrence Berkeley National Laboratory

Millennium Institute for Astrophysics (Chile)

Northwestern University

Tel Aviv University

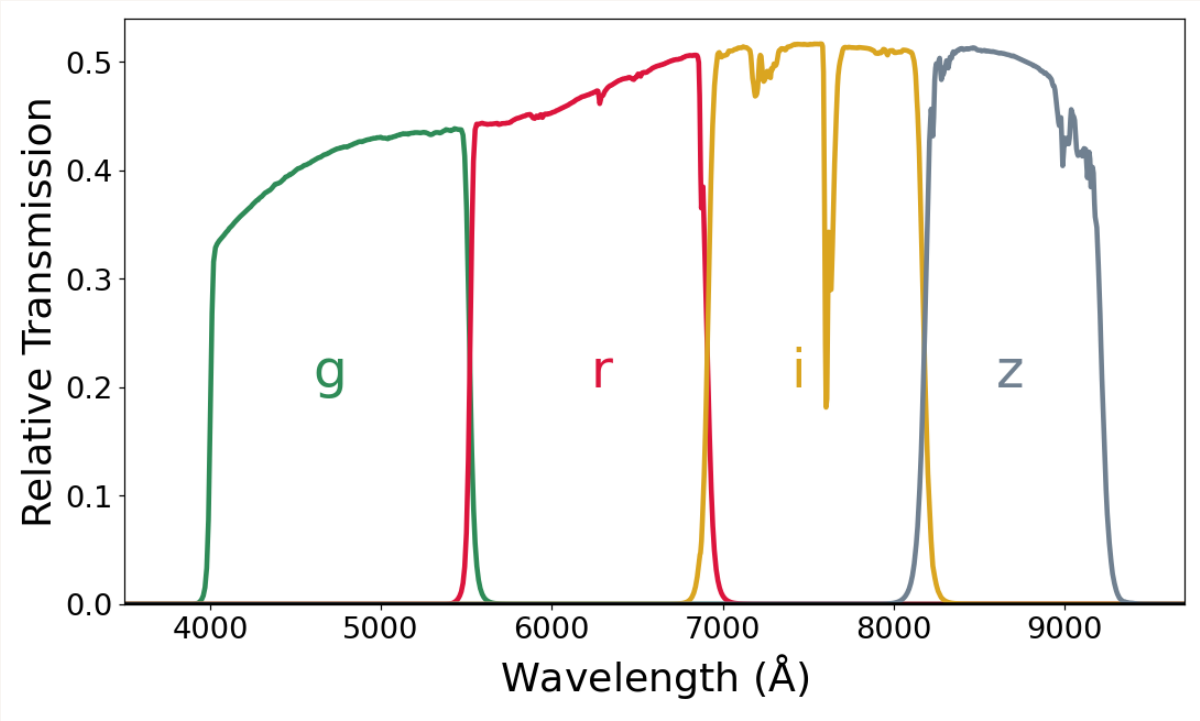
UC Berkeley

University of Portsmouth

Yale

LS4 Detectors

Red-sensitive LBNL CCDs



LS4 Detectors

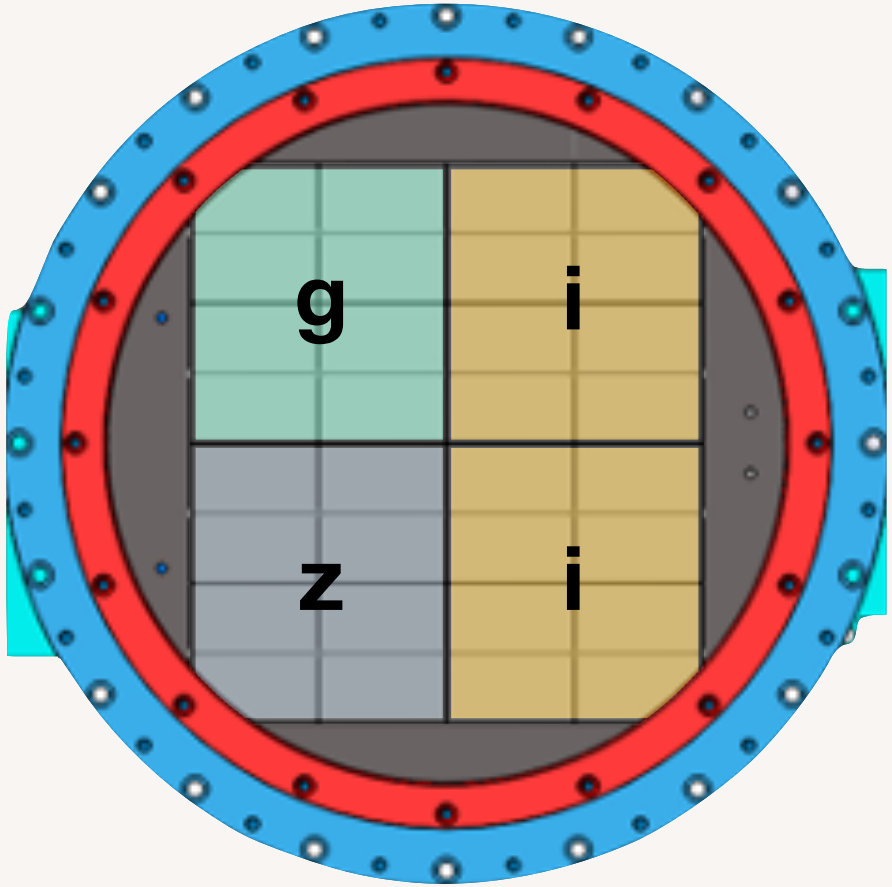
Red-sensitive LBNL CCDs

no filter wheel

single “multi-passband” filter

dither for colors

g+i+i+z filters



LS4 Science

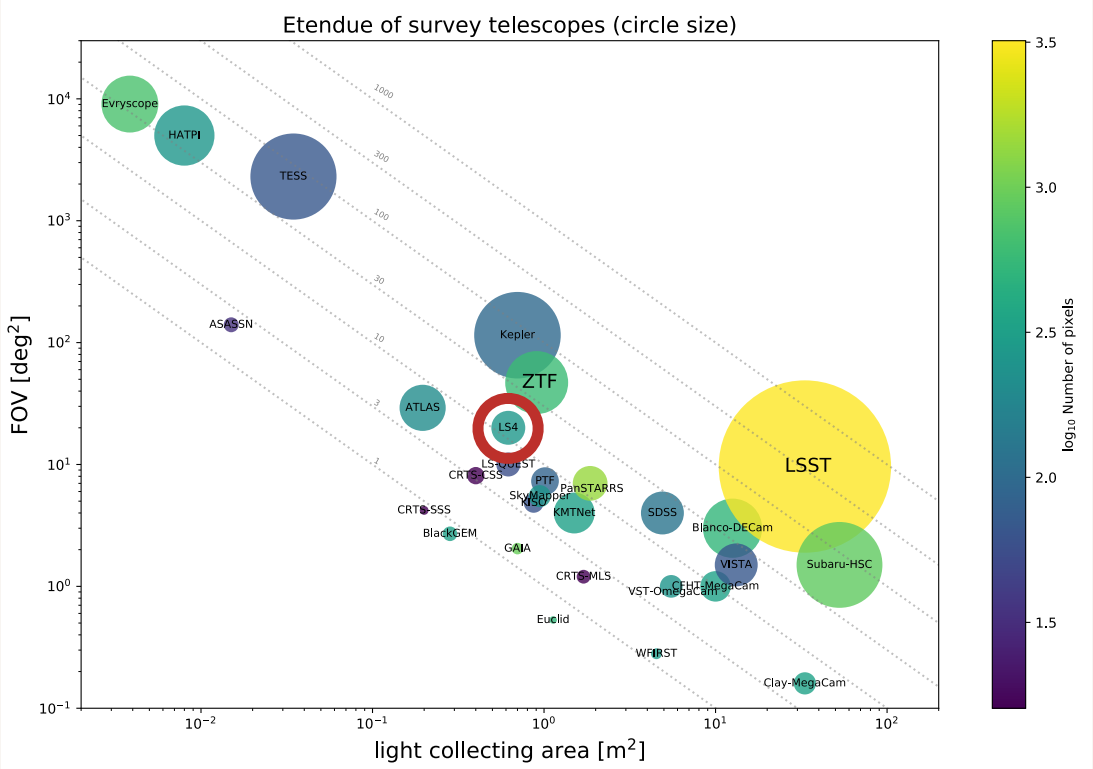
Public survey

90% of open shutter time

Rolling extragalactic survey
- g+i one night; i+z the next
- ~5000 deg^2 night^{-1}
- ~9 months year^{-1}

Focused galactic plane survey
- high-cadence (EBs + microlensing)
- ~3 months year^{-1}

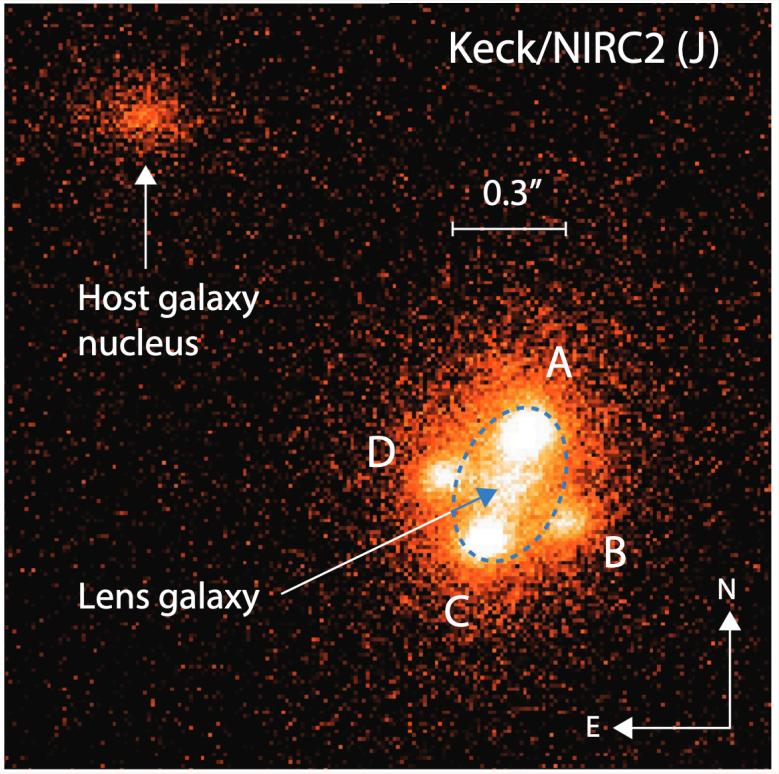
Public transient/variable alerts



LS4 Science

Rolling extragalactic survey

Gravitationally lensed SNe



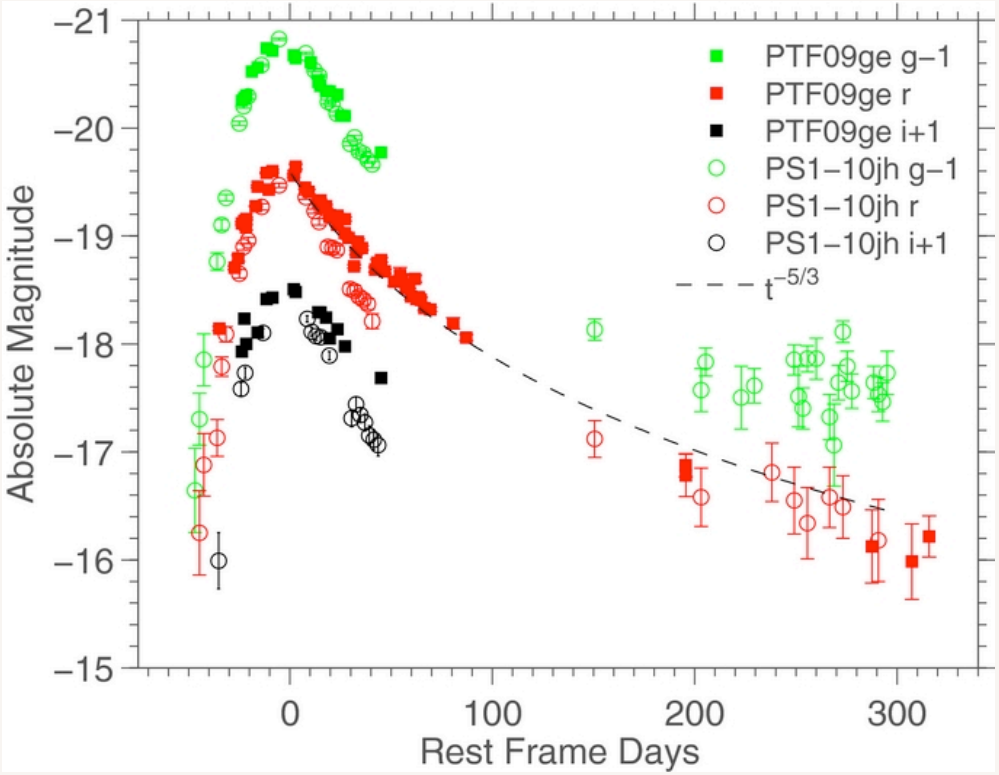
Goobar et al. 2023

LS4 Science

Rolling extragalactic survey

Gravitationally lensed SNe

Tidal Disruption Events



Arcavi et al. 2014

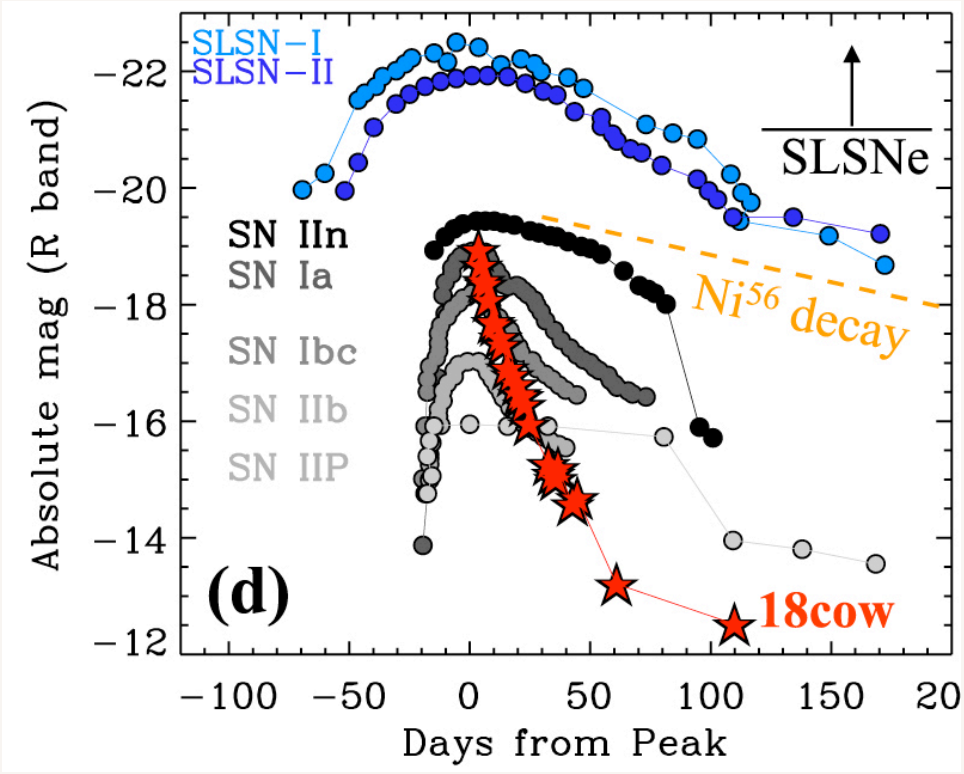
LS4 Science

Rolling extragalactic survey

Gravitationally lensed SNe

Tidal Disruption Events

Fast Blue Optical Transients



Margutti et al. 2019

LS4 Science

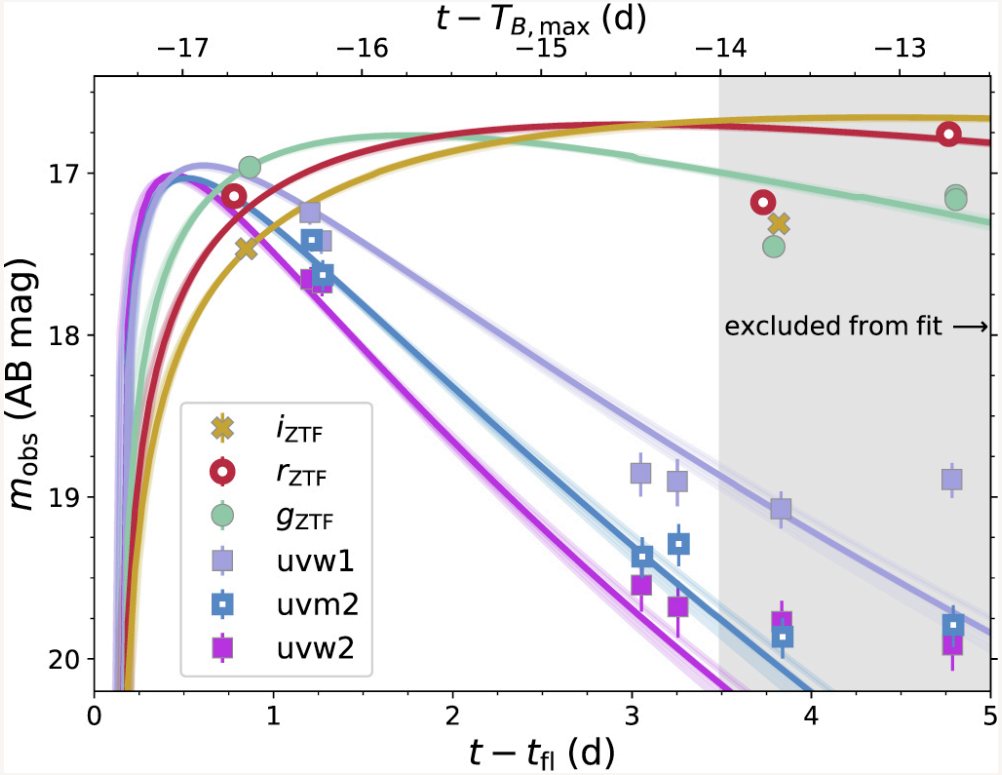
Rolling extragalactic survey

Gravitationally lensed SNe

Tidal Disruption Events

Fast Blue Optical Transients

Infant SNe



Miller et al. 2020

LS4 Science

Rolling extragalactic survey

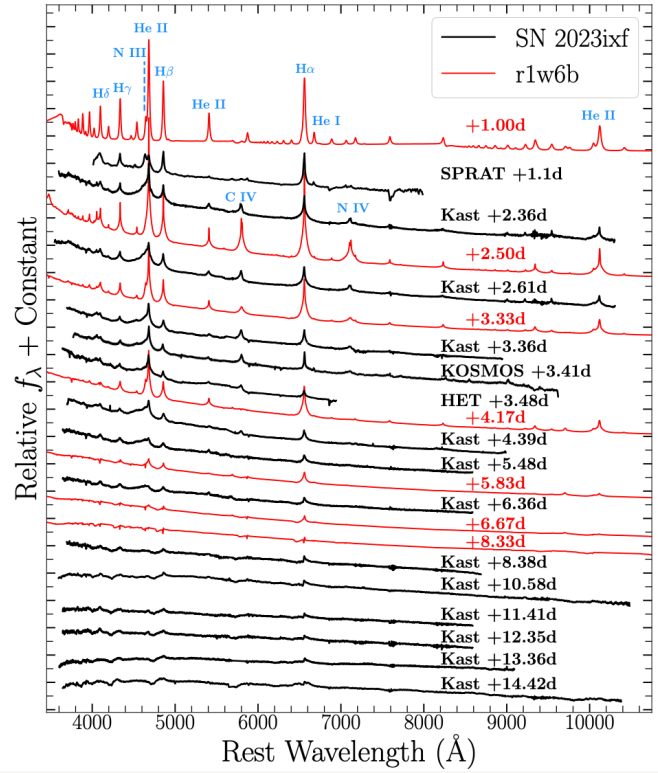
Gravitationally lensed SNe

Tidal Disruption Events

Fast Blue Optical Transients

Infant SNe

Flash spectroscopy



Jacobson-Galán et al. 2023

LS4 Science

Rolling extragalactic survey

Gravitationally lensed SNe

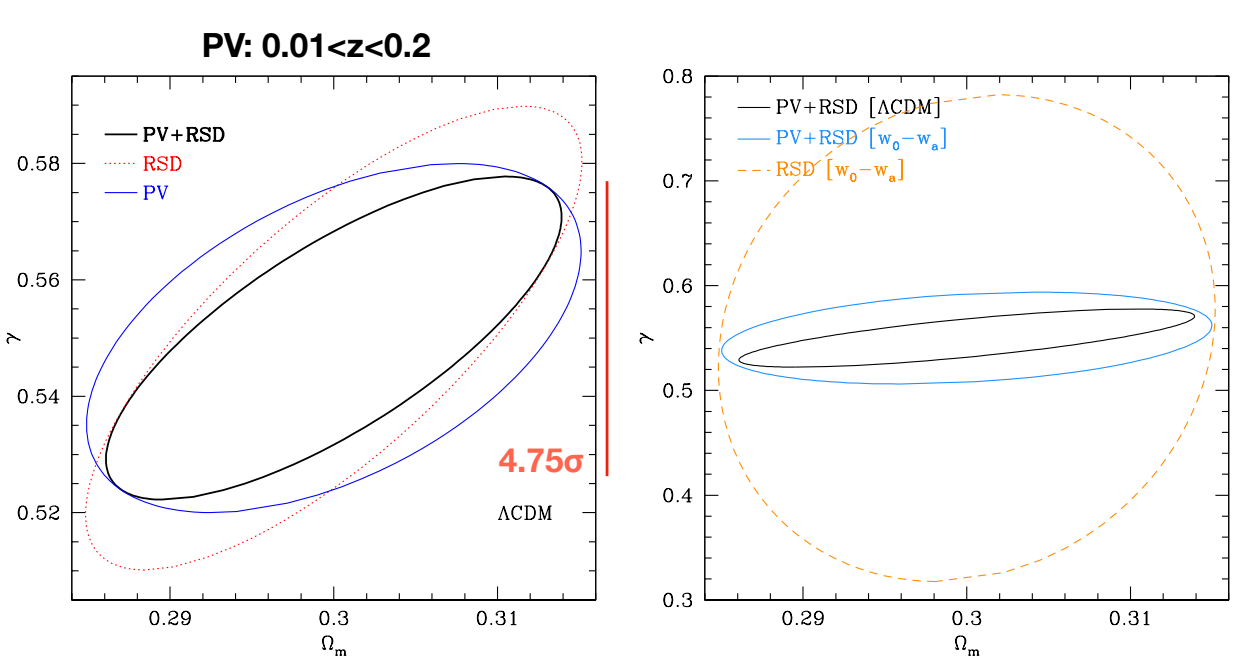
Tidal Disruption Events

Fast Blue Optical Transients

Infant SNe

Flash spectroscopy

SNe Ia + peculiar velocities



Kim & Linder 2020

LS4 Science

Rolling extragalactic survey

Gravitationally lensed SNe

Tidal Disruption Events

Fast Blue Optical Transients

Infant SNe

Flash spectroscopy

SNe Ia + peculiar velocities

Your favorite theorist’s favorite idea

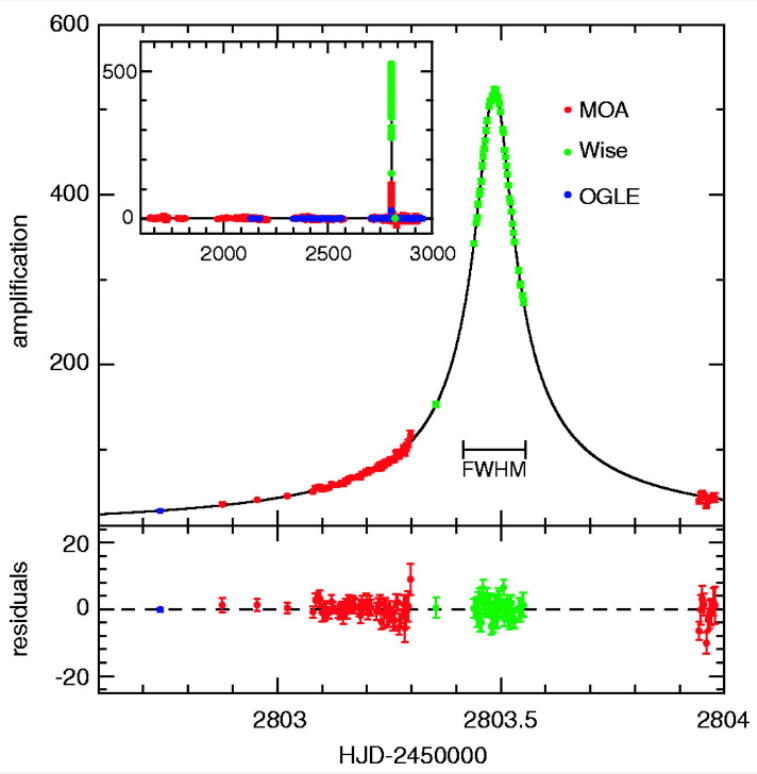
LS4 Science

Focused galactic plane survey

Microlensing

Ultra-short period binaries

Future merging WD systems



Abe et al. 2004

LS4 Science

Private partner observations

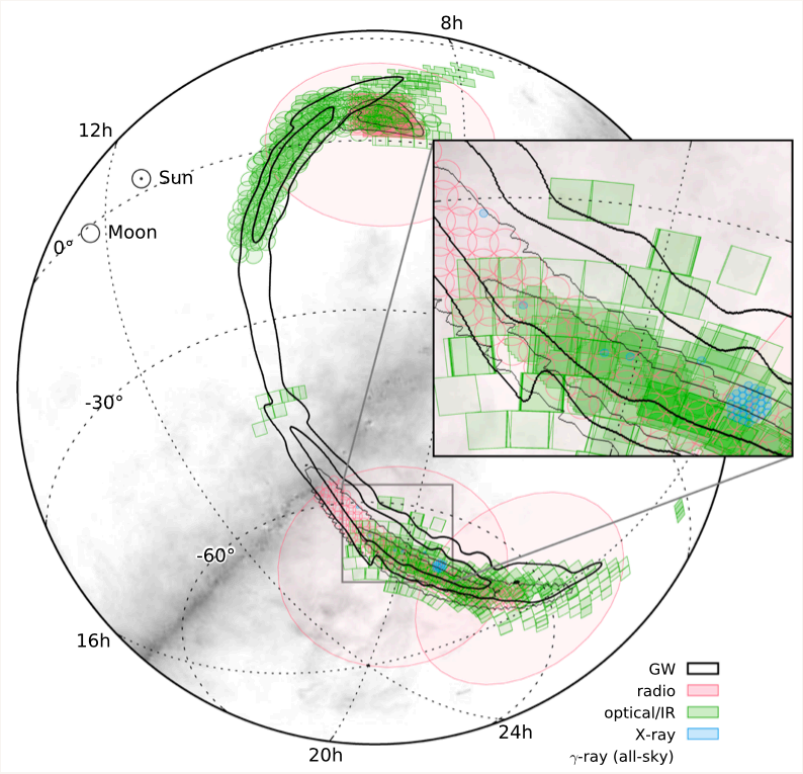
10% of open shutter time

ToO for multi-messenger astronomy

Special projects

e.g., deep drilling fields, co-observing with space-based facilities

Alerts reserved for collaboration



Abbott et al. 2016

LS4 Science

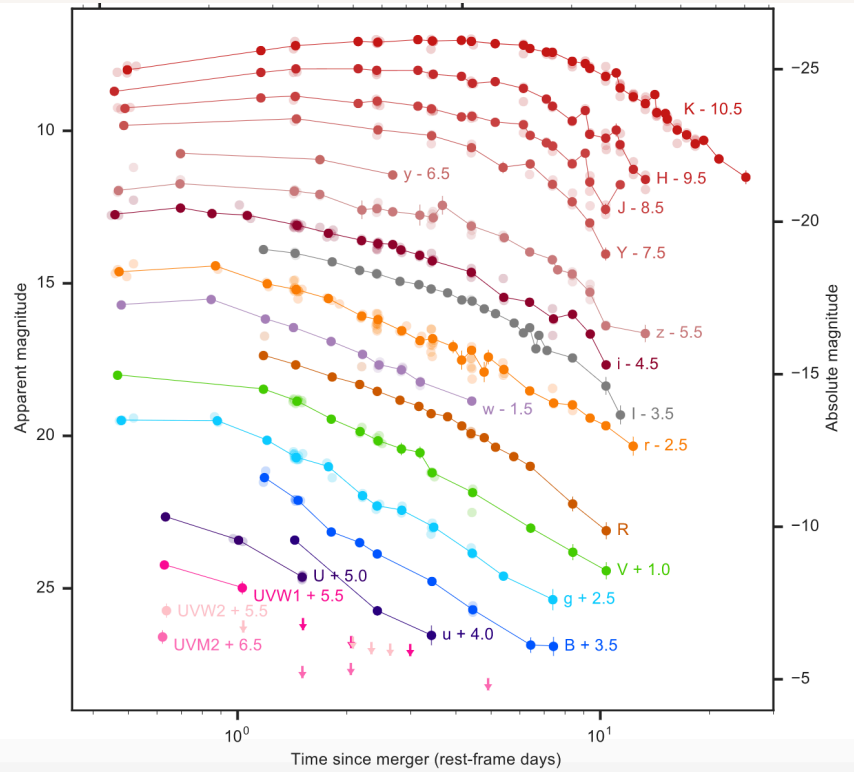
Private partner observations

10% of open shutter time

ToO for multi-messenger astronomy

Special projects
e.g., deep drilling fields

Alerts reserved for collaboration



Arcavi et al. 2018

Conclusions

LS4 - new, wide-field, time-domain survey

ESO 1m Schmidt telescope

red sensitive CCDs (g+i+i+z)

90% of observing time produces public alerts

complementary to Rubin/LSST

tuned for GW and other MMA

image credit: ESO