

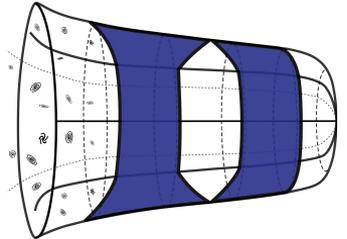
# The Dark Energy Bedrock All-Sky Supernova Survey

9/23/2025

Maria Acevedo

Duke University

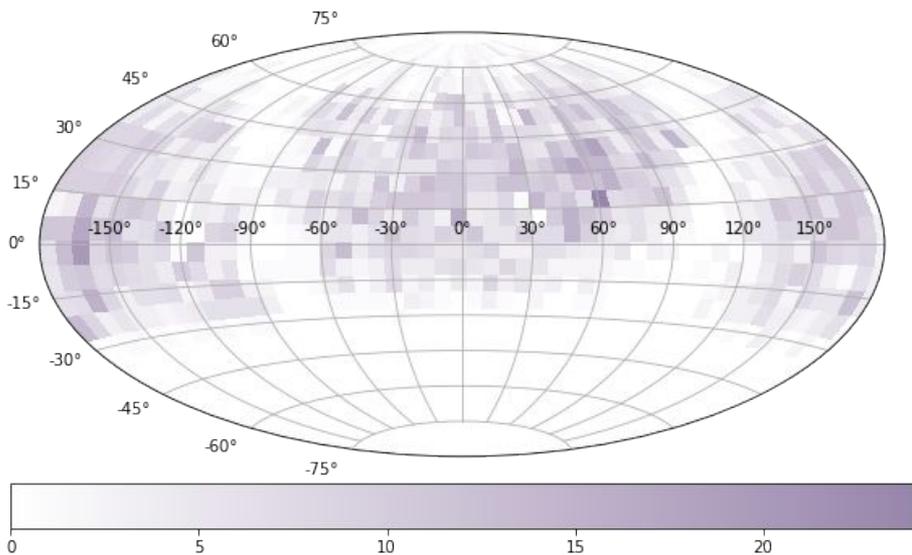
[maria.acevedo@duke.edu](mailto:maria.acevedo@duke.edu)



Duke Cosmology



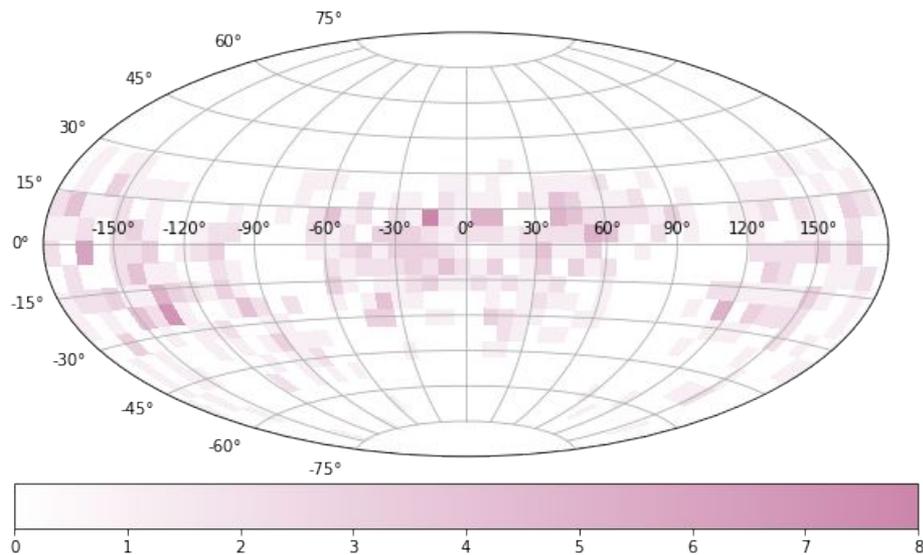
# Number of Low Redshift SNe



**Number of ZTF SNe**

3628 nearby ( $z < 0.3$ ) SNe Ia (Rigault et al. 2025)

- Hubble scatter of 0.15 mag

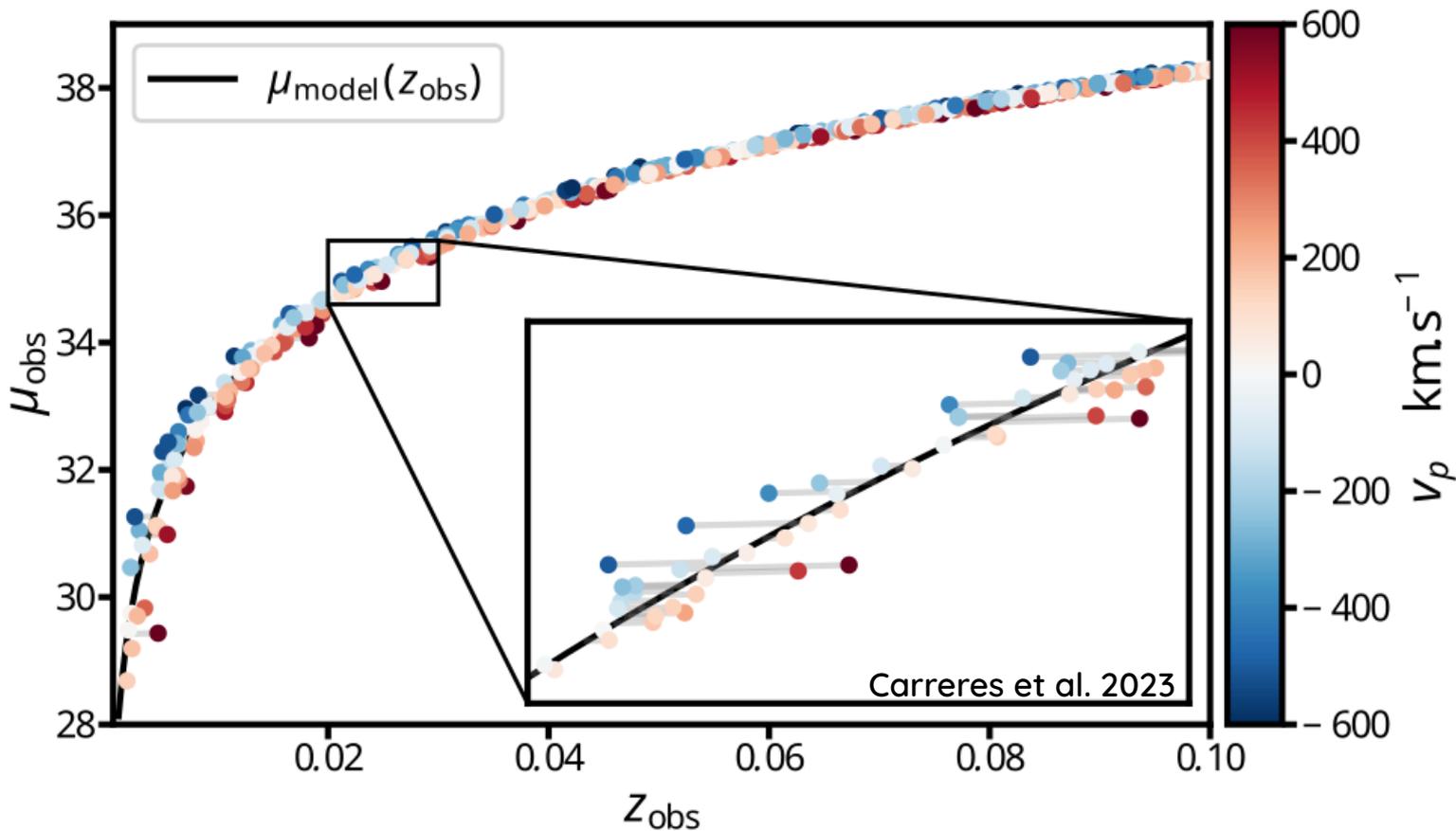


**Number of DEBASS SNe**

542 spectroscopically confirmed SNe Ia and counting ( $0.01 < z < 0.1$ )

- 77 released in Sherman et al. 2025
- Hubble scatter of  $\sim 0.1$  mag

# Low-redshift SNe play a central role in cosmology



# DEBASS: Blanco Telescope (DECam)



## Location

Cerro Tololo  
Inter-American  
Observatory,  
Chile



## Field of View

3 square  
degrees (2.2°  
wide)



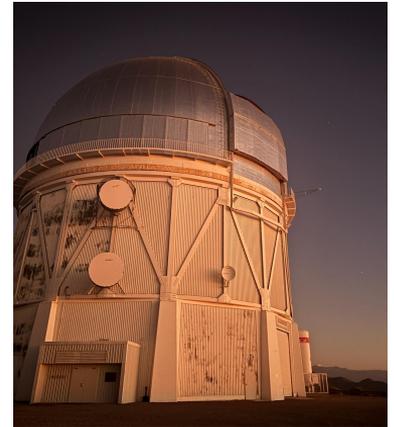
## Seeing

Average of 1  
arcsec



## Filters

u g r i z Y



# DEBASS: Blanco Telescope (DECam)



## Location

Cerro Tololo  
Inter-American  
Observatory,  
Chile



## Field of View

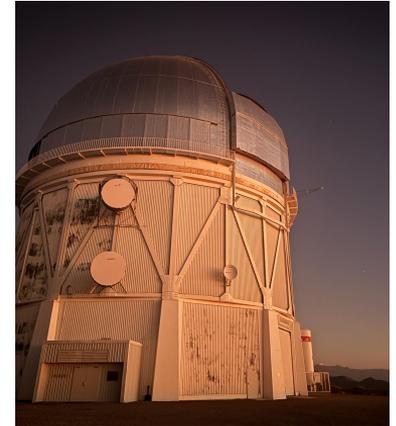
3 square  
degrees (3  
wide)

This is the same  
telescope used for  
DES which means  
no internal cross  
calibration  
required!

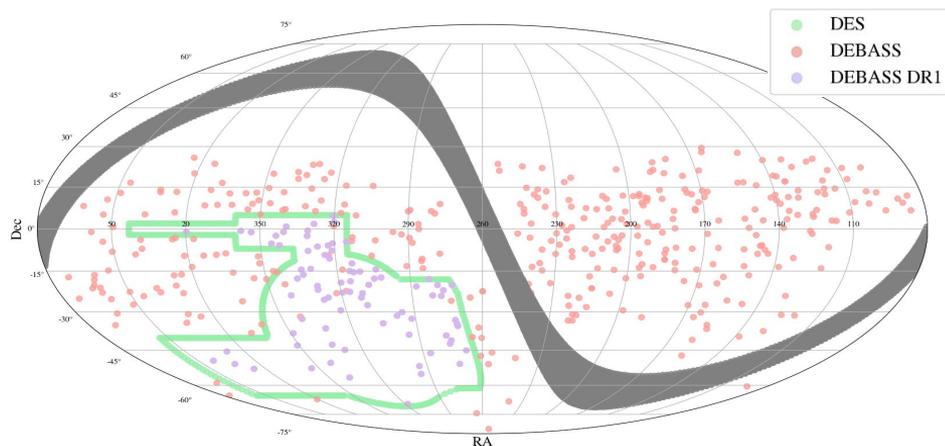


## Filters

g r i z Y



# DEBASS Builds a Low-z Sample

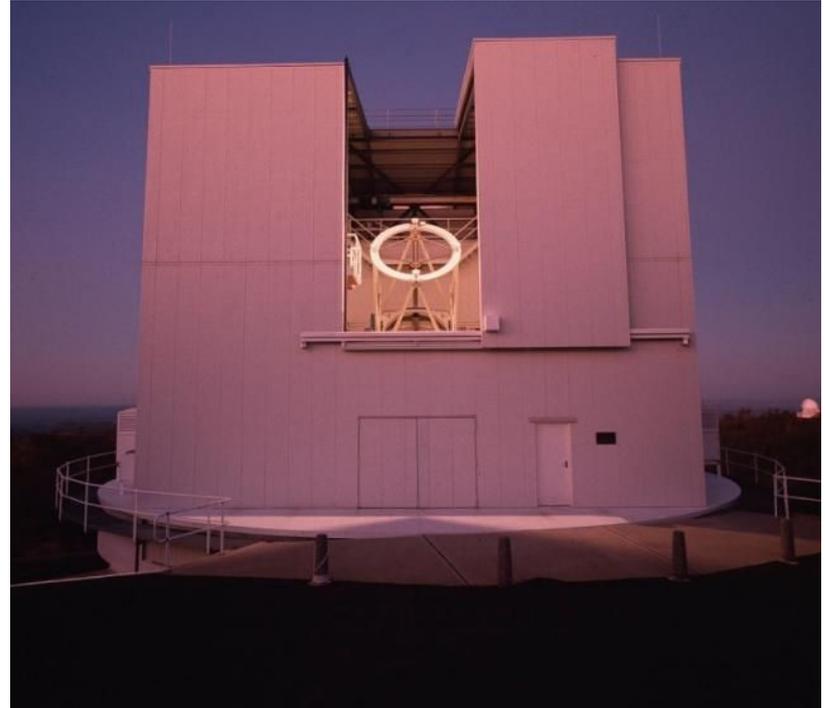


## Follow-up SNe across the sky

- We select SNe within the Hubble flow ( $0.015 < z < 0.1$ )
- Priority is given to spectroscopically confirmed transients that will be observable by DECam for at least 45 days
- In total we have observed over 500 SNeIa

# Spectroscopic Confirmation (mostly) comes from WiFeS

- Wide Field Spectrograph (WiFeS)
- Mounted on 2.3-meter ATT at Siding Spring Observatory in Australia
- Spectroscopic confirmation of Type Ia
  - Dedicated host follow-up after SN has faded (230 so far)

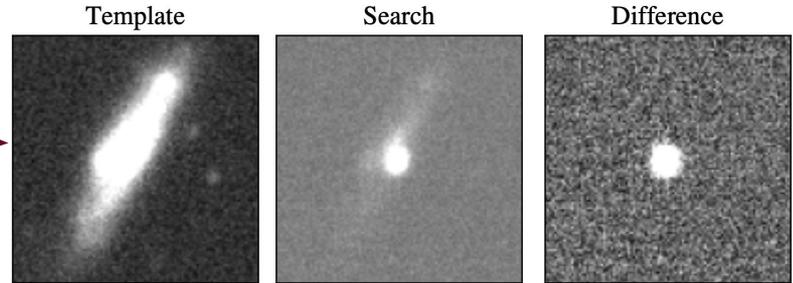


# DEBASS Uses the DESSN Pipeline



## Image Processing

1. Single Epoch Processing: refines and corrects images on the pixel level
2. Difference Imaging: subtracts templates from SE processed images to highlight transients

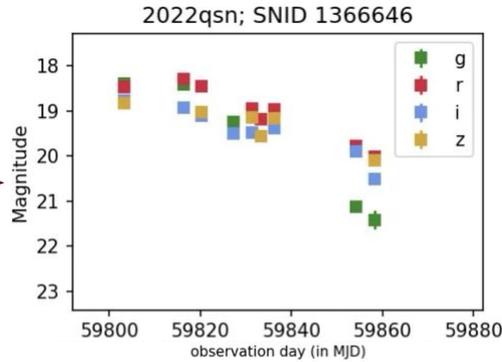


Sherman, **Acevedo**, et al. 2025  
Morganson et al. 2018

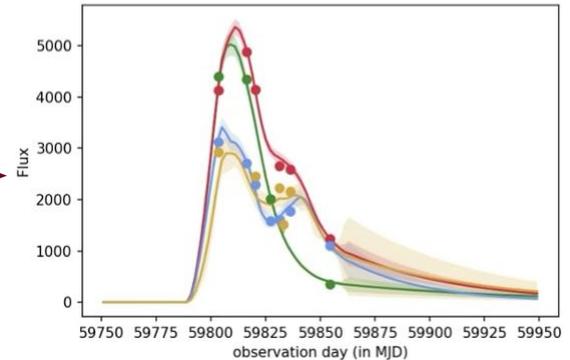
Herner et al. 2020  
Kessler et al. 2015

# DEBASS Uses the DESSN Pipeline

Once we have our processed images, we run forced photometry on the position of our SN

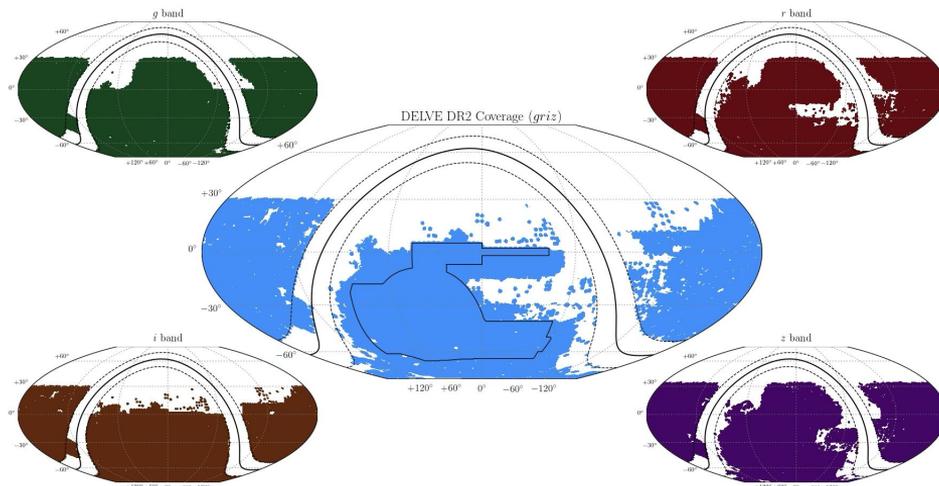


We then fit our data using SuperNova ANALysis (SNANA)



# DEBASS: Internal Calibration

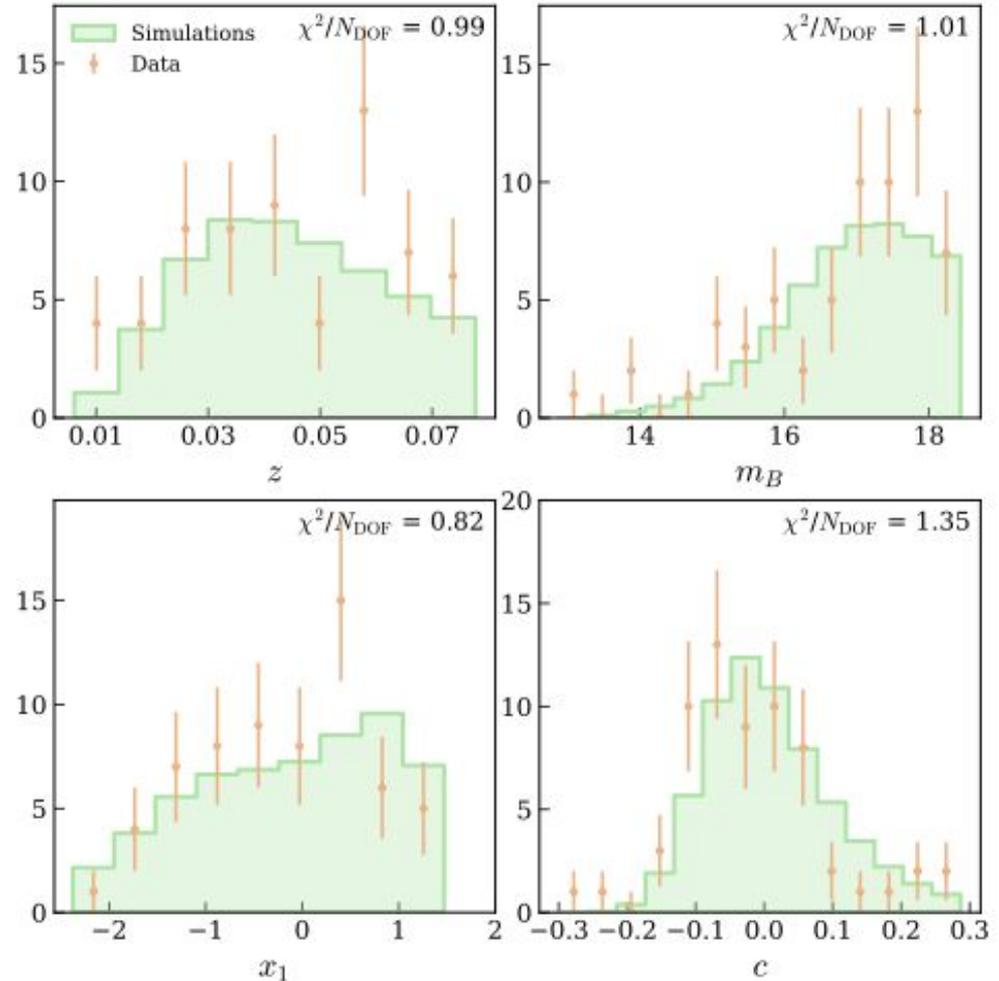
- When available, we use DELVE DR2 as our reference catalog
- DECam-based survey
  - Uses DES images and calibration within the DES footprint
- We found the residuals in the nightly magnitude of stars calculated in our pipeline compared to the DES5YR catalog to be  $\sim 0.001$  mag

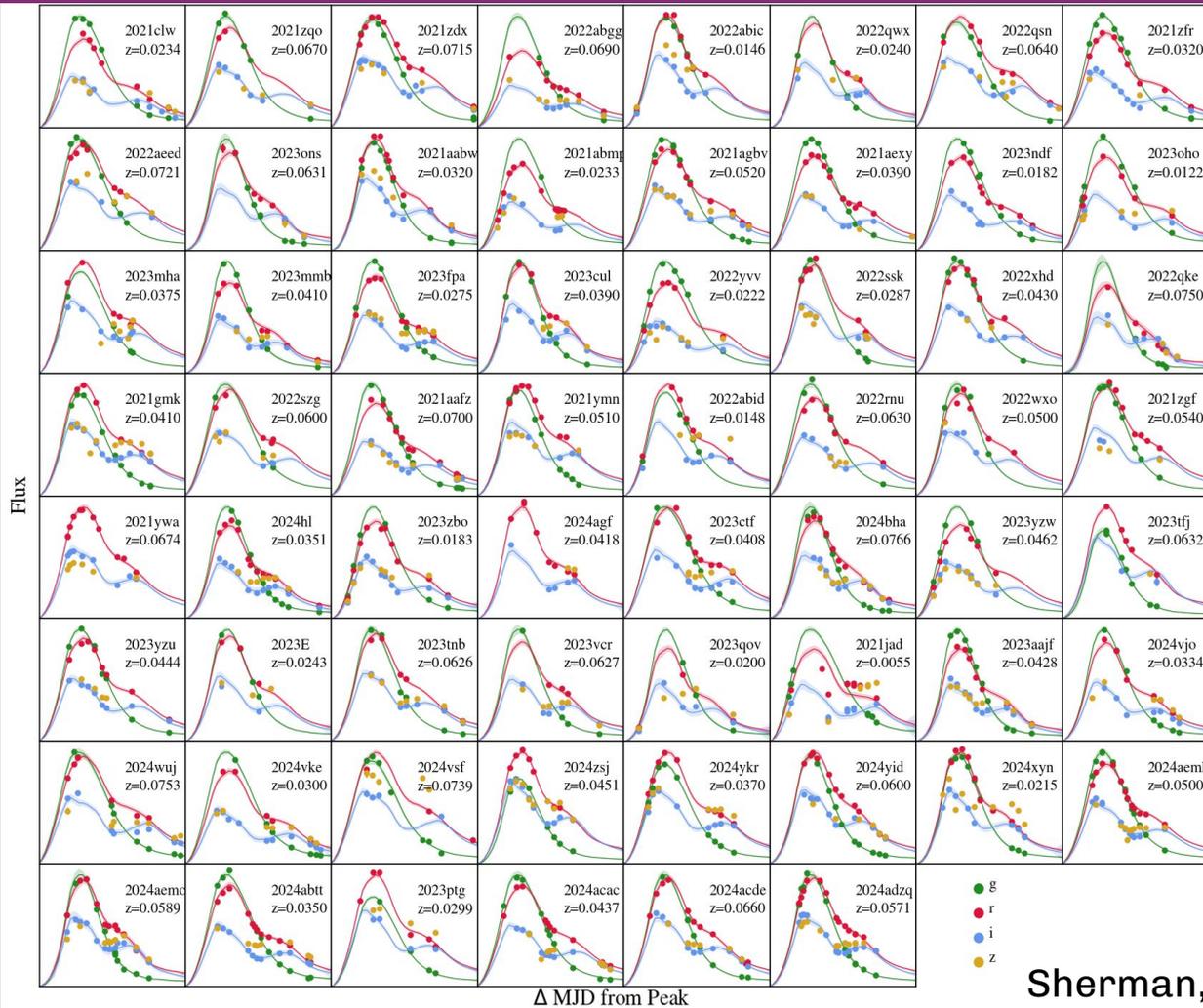


Acevedo et al. 2025

# DEBASS is a Follow-Up Survey

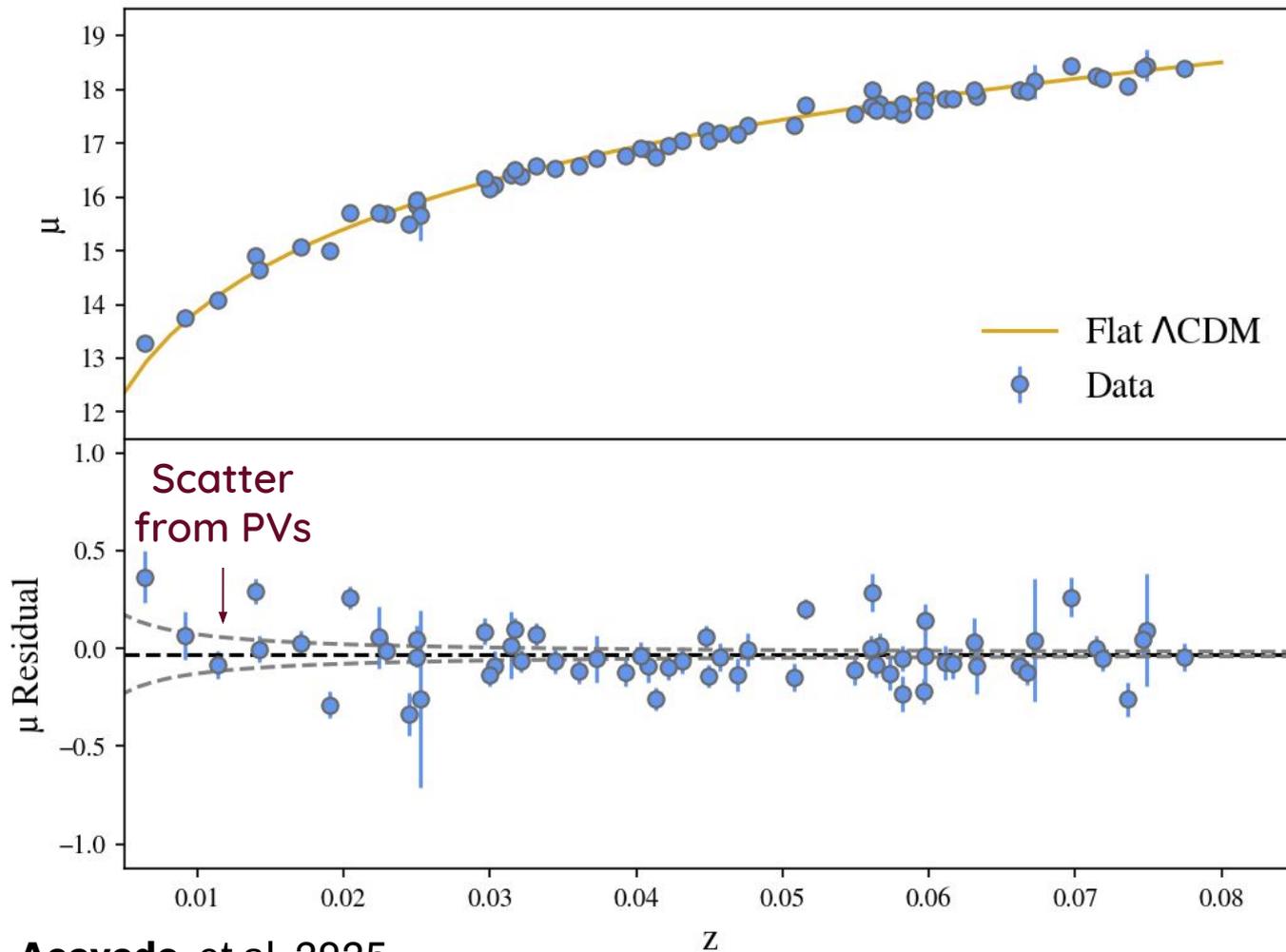
- Selection depends on:
  - External discoverer survey depth/footprint
  - Spectroscopic availability
  - DECam follow-up scheduling
- Requires a different selection function than a search survey
  - Done using SNANA simulations





# 62 High-Quality Light Curves from DR 0.5

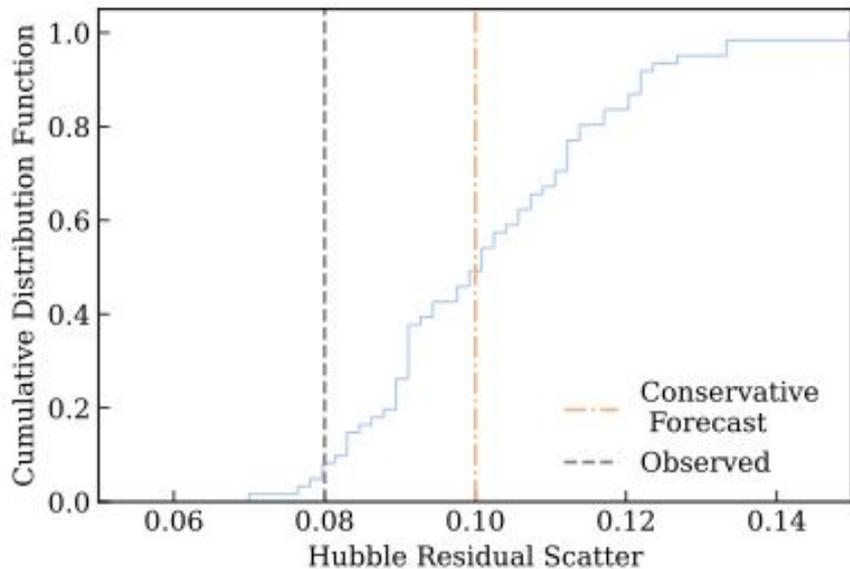
Sherman, Acevedo, et al. 2025



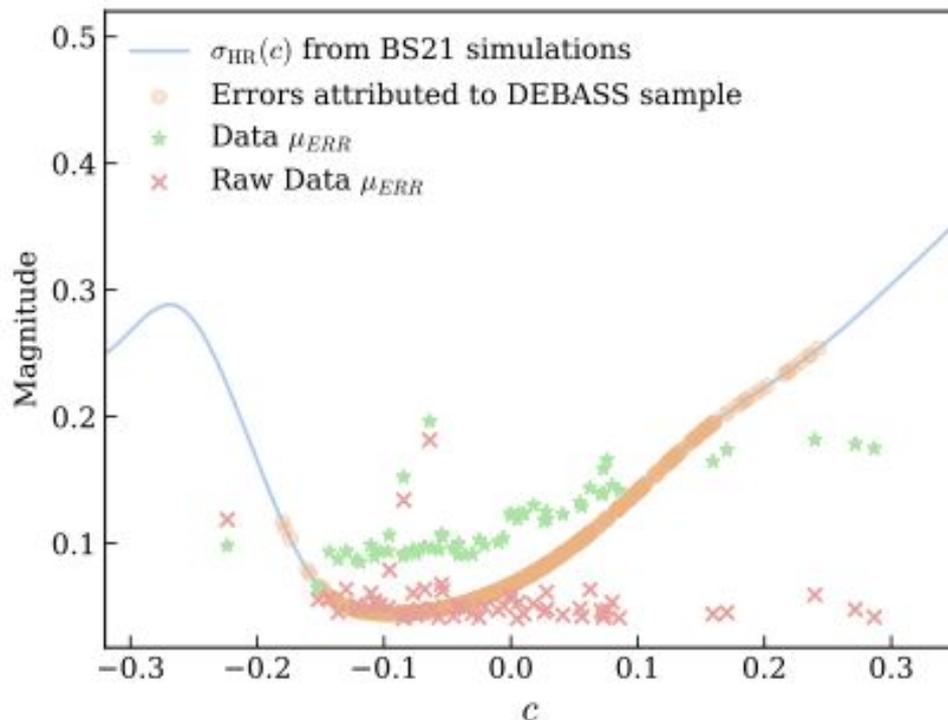
Hubble  
scatter of  
 $\sim 0.1$  mag!

# Our scatter really is that low!

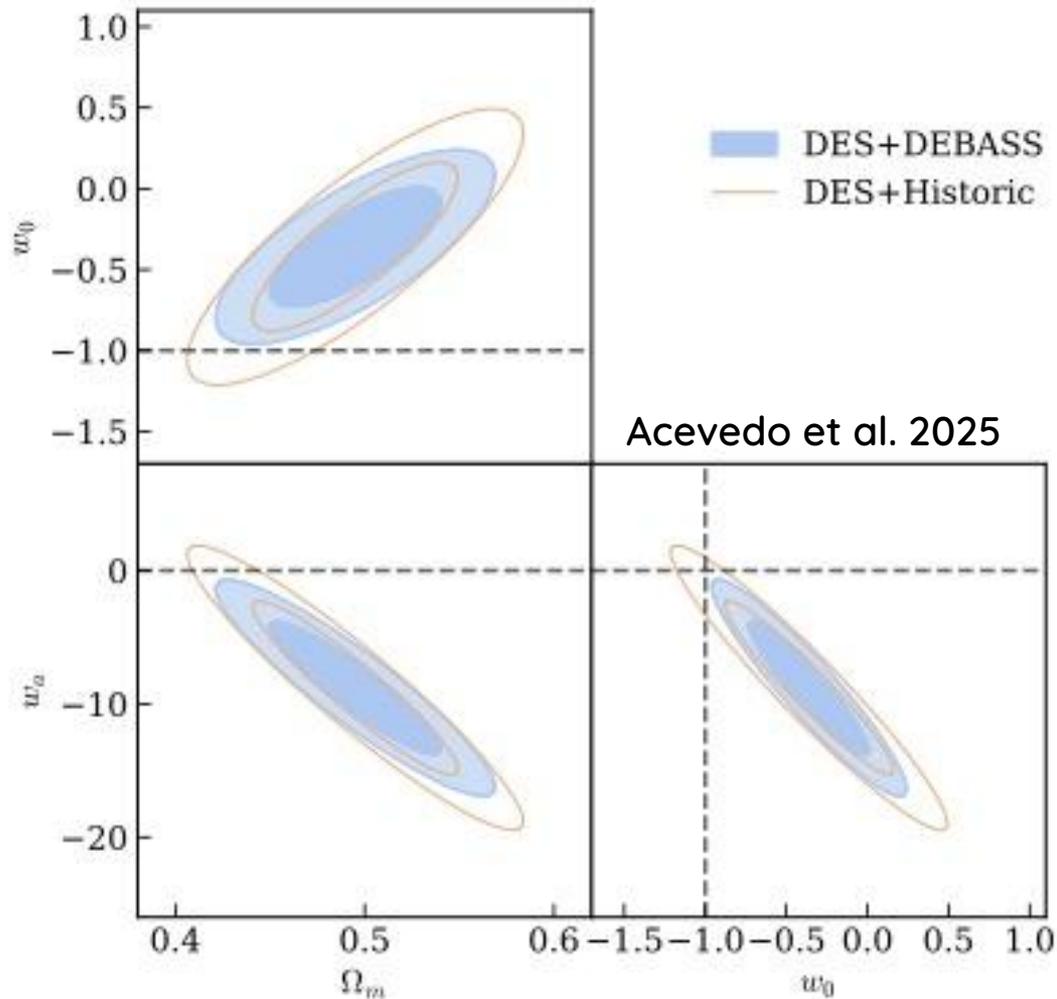
Acevedo et al. 2025



Simulations of 62 SNe Ia with bias corrections



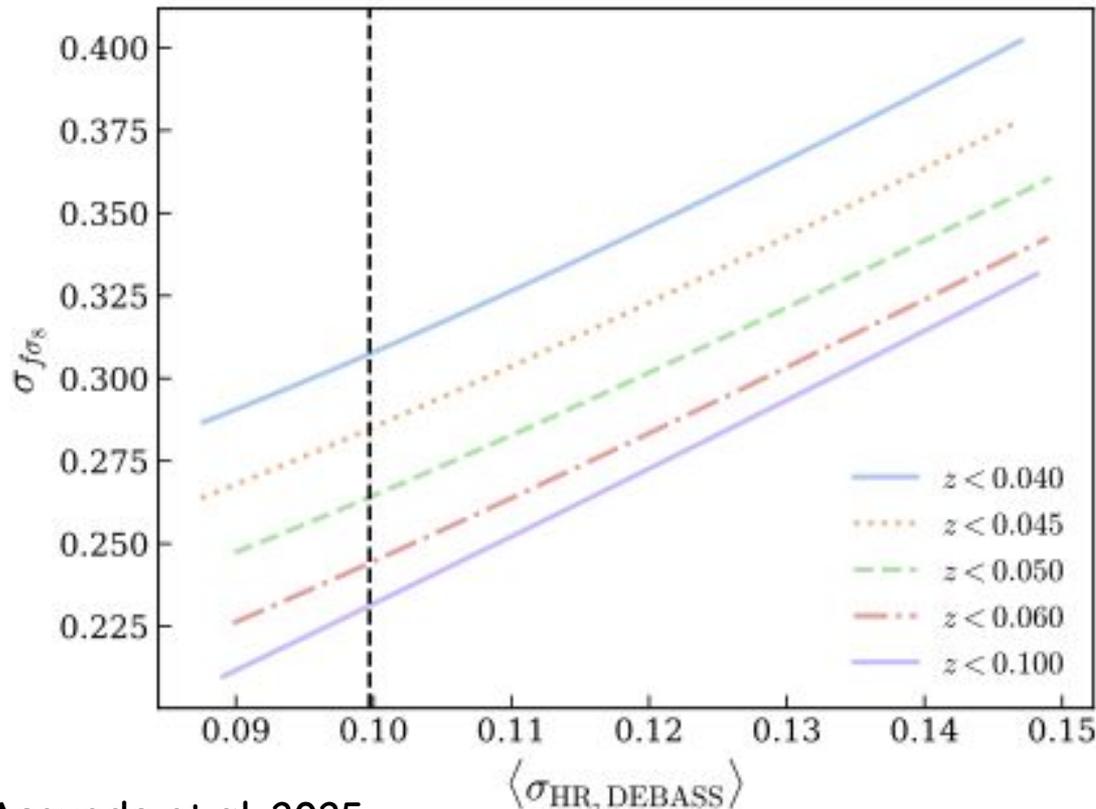
Color dependence of Hubble scatter



## Simulations & Cosmological Forecasts

Forecasts with  $\sim 400$  DEBASS SNe: 30% reduction in  $w_0$ , 24% reduction in  $w_a$

# Lower scatter is vital for $f\sigma_8$



Tighter distance uncertainties  $\rightarrow$  better PV estimates

Flip forecasts  $\sim 25\%$  precision on  $f\sigma_8$  with only 400 SNe

We can start to probe other systematics for  $f\sigma_8$

# Summary

- DEBASS: uniform, low- $z$ , low-scatter SN Ia survey
- Current DR0.5: 62 SNe with  $\sigma \sim 0.1$  mag
- Forecasts:  $\sim 400$  SNe  $\rightarrow$  24% improvement on  $w_a$  and 25% precision on  $f\sigma_8$
- Next set of papers: full Data Release 1 and Cosmology expected in 2026

