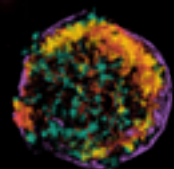


# MULTI-OBJECT SPECTROSCOPY OF SNE IA HOST GALAXIES: LESSONS FROM DES

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University of Pennsylvania







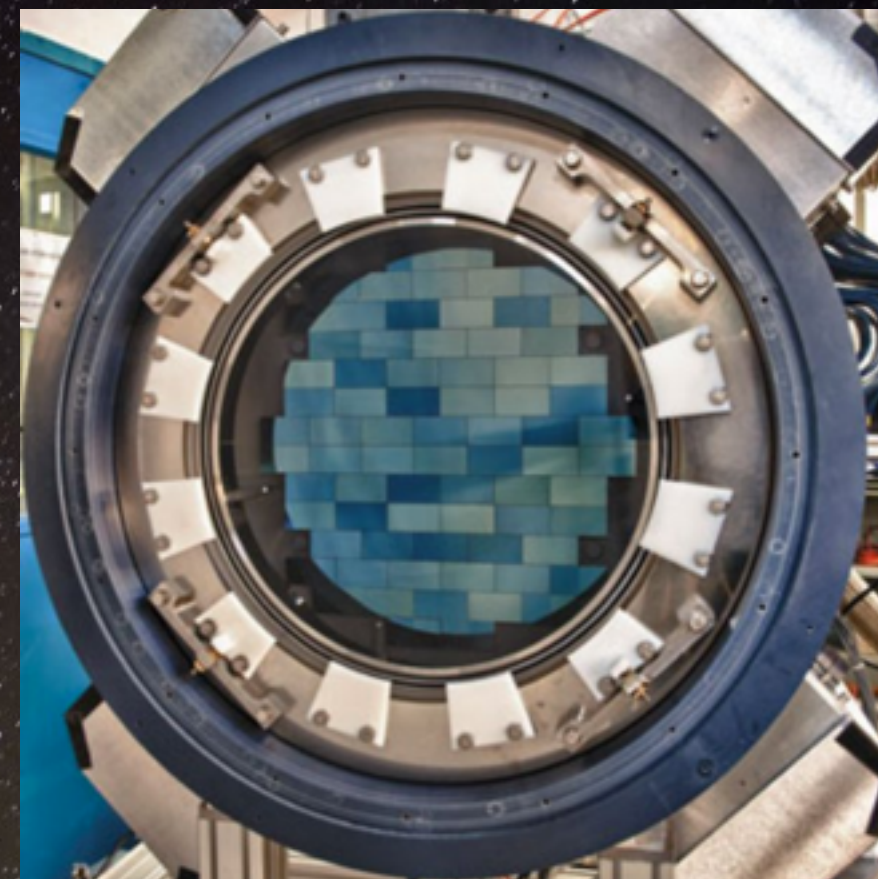
Multi-component survey designed to probe *dark energy* and origin of cosmic acceleration

### DES-Wide

- 5000 deg<sup>2</sup> in *grizY*:  $r_{AB} \sim 24.3$ ,  $i_{AB} \sim 23.5$  ( $10\sigma$ )
- Large Scale Structure; Weak Lensing; Galaxy Cluster

### DES-SN

- $\sim 6$ -day cadenced *griz* survey over  $\sim 5.5$  month season
- 10 pointings covering 27 deg<sup>2</sup>
- Type Ia supernovae cosmology
- 3500 type Ia supernovae to  $z \sim 1.2$



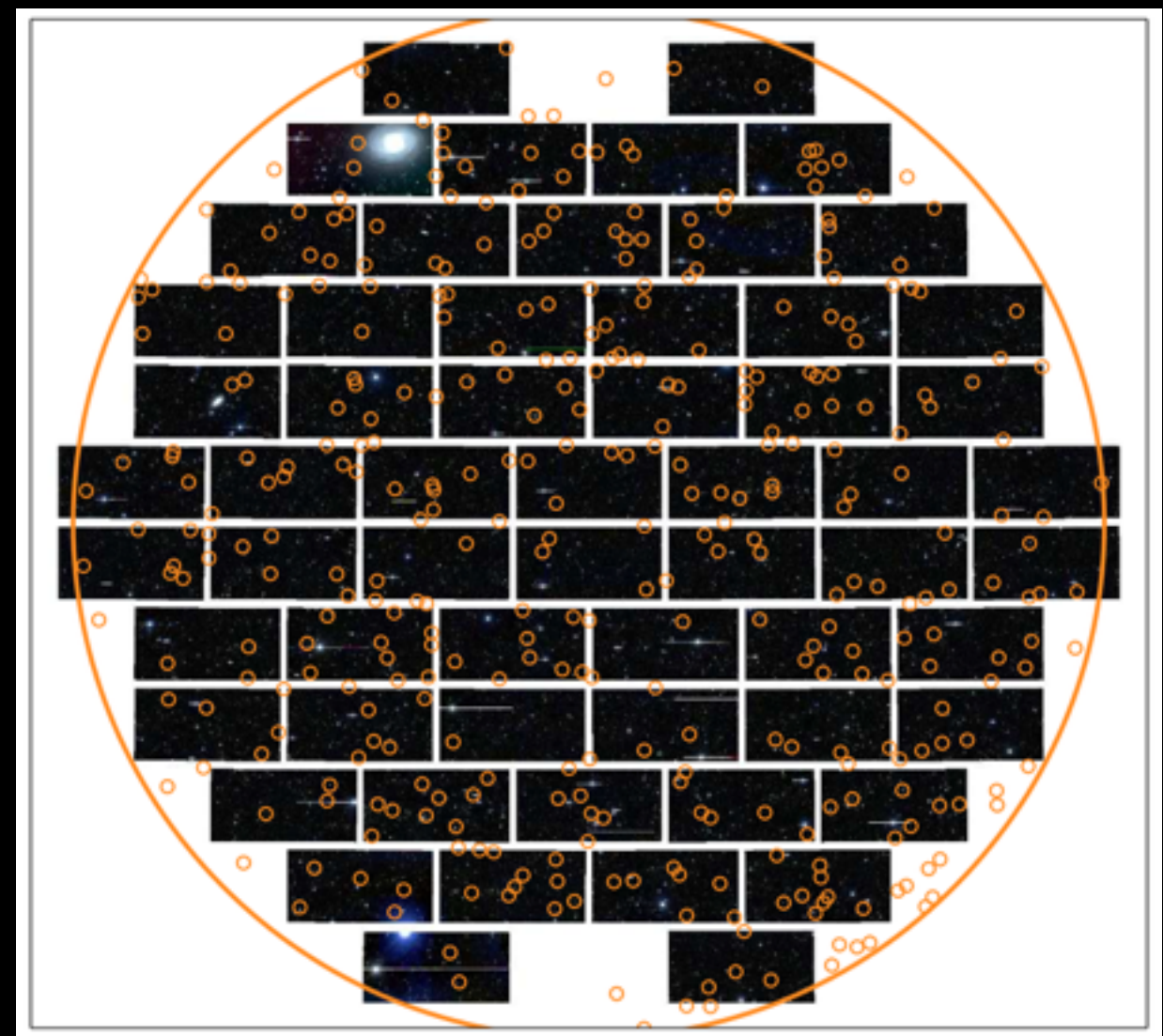
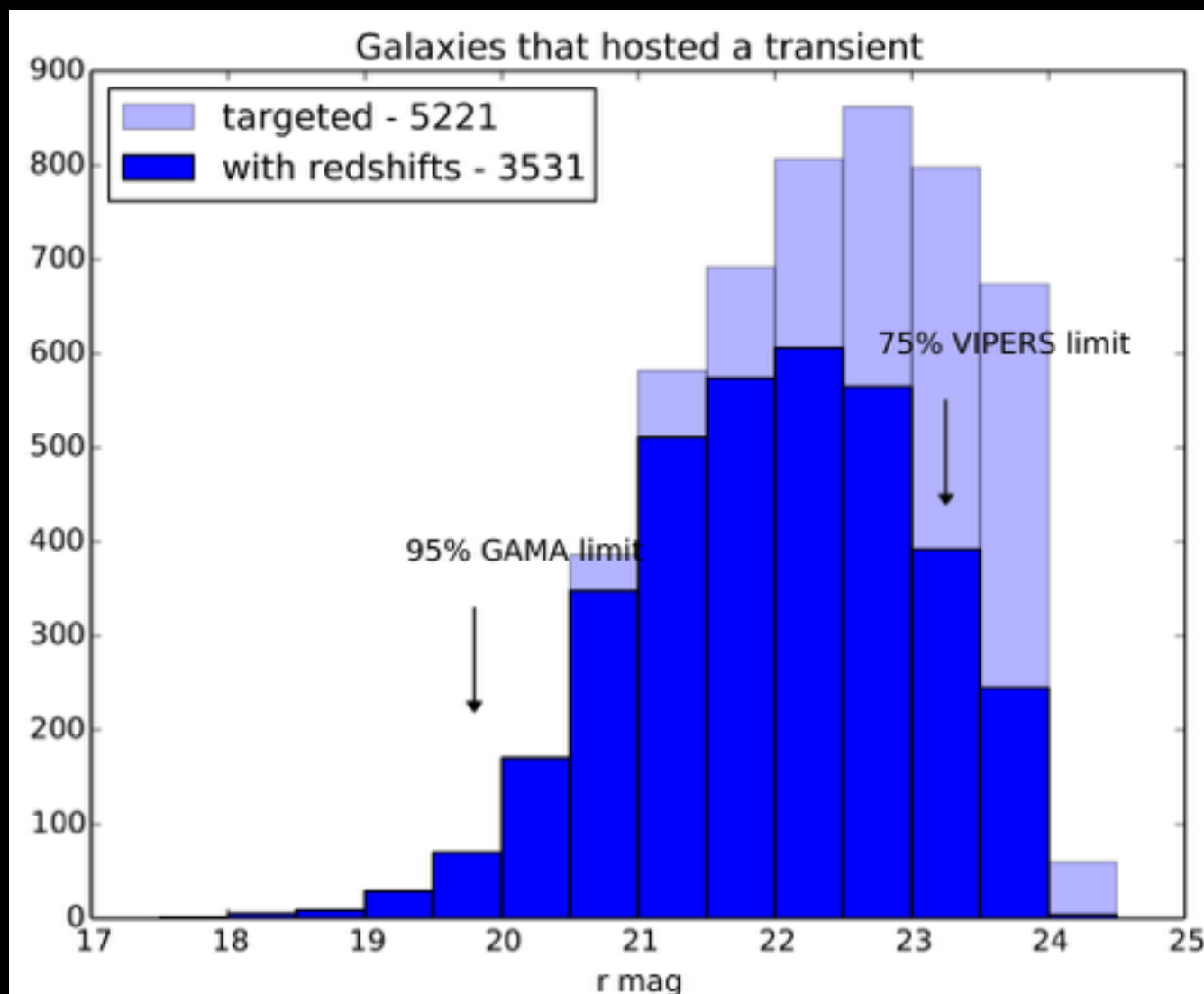
Dark Energy Camera (DECam) on 4m Blanco Telescope at CTIO

- 520 Mpx camera; 3 deg<sup>2</sup> FoV; deep-depleted LBNL CCDs
- Allocated 525 nights over 5 observing seasons (Aug - Feb, 2013 - 2018)
- *DES4: 13 August 2016 - 18 February 2017*



# HOST MOS WITH OZDES

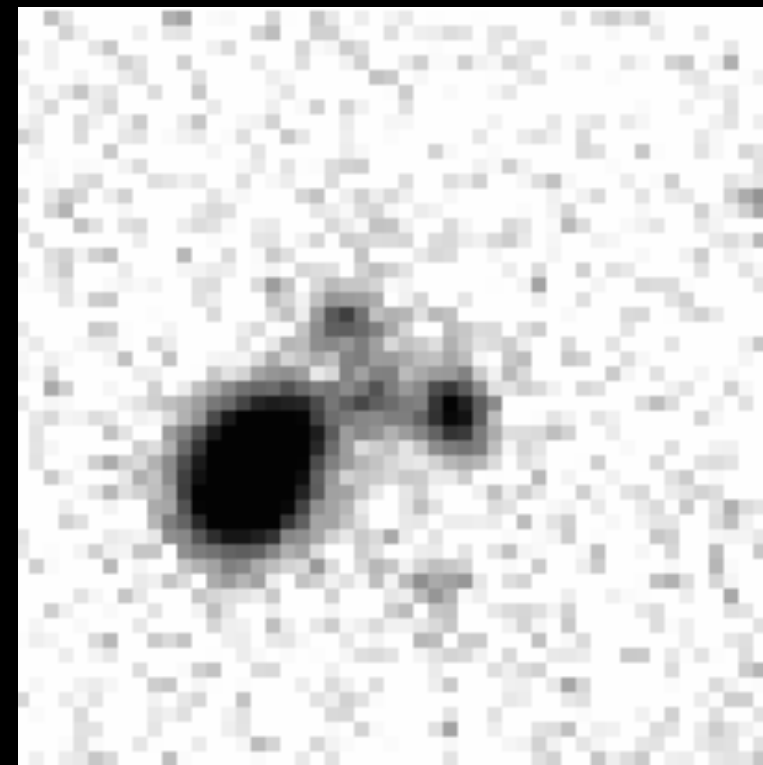
- AAOmega/2dF on AAT: near-perfect overlap with DECam FoV
- 100 night program overlapping with DES
- SN Host Galaxies can be repeatedly targeted to build up depth; Live transients targeted as well
- Majority of fibers allocated to non-SN DES programs
- OzDES Overview Papers: Y1 (Yuan+2015), Y3 (Childress+in prep)



Courtesy C. Lidman

# HOST IDENTIFICATION

- How do you determine what is the host?
  - Nearest host in catalog in angular separation (limit?)
  - Nearest host in catalog in directional light radii (DLR) (limit?)
  - Do you target multiple hosts if there is 'host confusion'? (fiber collisions)
  - What if the host is fainter than the catalog depth?



3 galaxies within 3", DLR < 3

# TARGETING STRATEGY

## Algorithm

- Magnitude limit on host followup?  
Color selections?  
Photo-z prior?
- All transients; all SN candidates; just SNIa candidates?

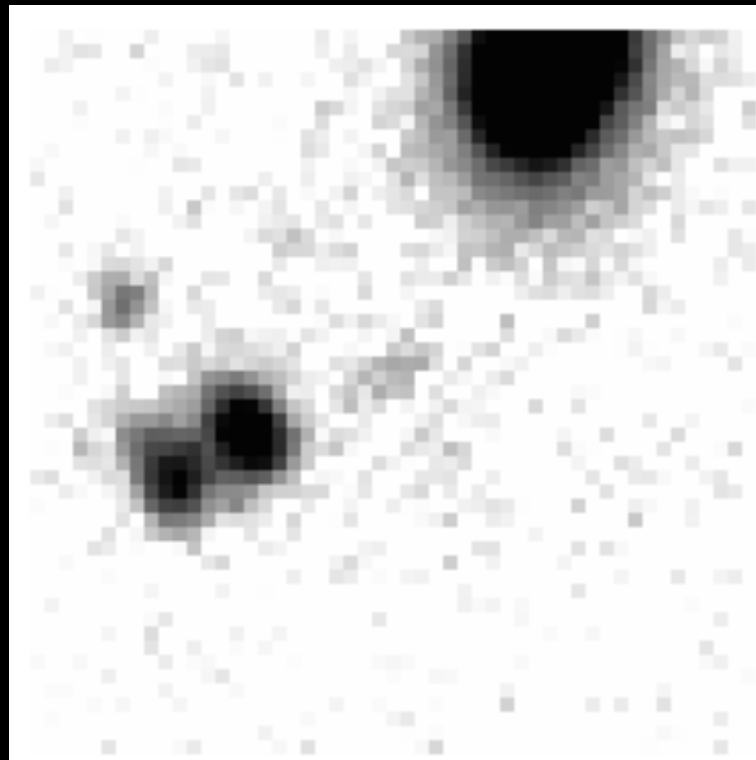
## Redshifting

- When do you have a *secure* redshift?  
(We've changed this over time: 95% → 99%)
- When do you *give up* on targeting?  
(N observations and no secure redshift.  
Can this cutoff be determined a-priori?  
Are the observing conditions taken into account?)
- Use of Ancillary Catalog  
(know a-priori to *NOT* target certain galaxies)

# SOURCE CATALOG

- What serves as the *INITIAL* catalog?
  - DES: SVA1!
- How do we update the catalog?
  - Mapping of objects from one catalog to another: keeping target ID consistent for targeting + spec coadding
  - Contamination of host (mag + position) for *all interesting galaxies* by SN light in multi-season catalogs

$$r_{\text{auto}} = 25.6$$
$$i_{\text{auto}} = 24.9$$



# OBSERVING STRATEGY

## Scheduling

- When does host followup begin?  
Balance of early science + active transients  
vs. source density + efficiency
- Live transients in DES with MOS:  
First season contaminated by variable stars, AGN, and artifacts.  
Also creates additional hosts to target, and later orphaned hosts.
- Observability of fields is important!  
Even in DES, there is significant bias in field observations  
DDF vs. WFD? — location of field SN is in ***is*** important