OBSERVING SUPERNOVAE WITH MKIDS

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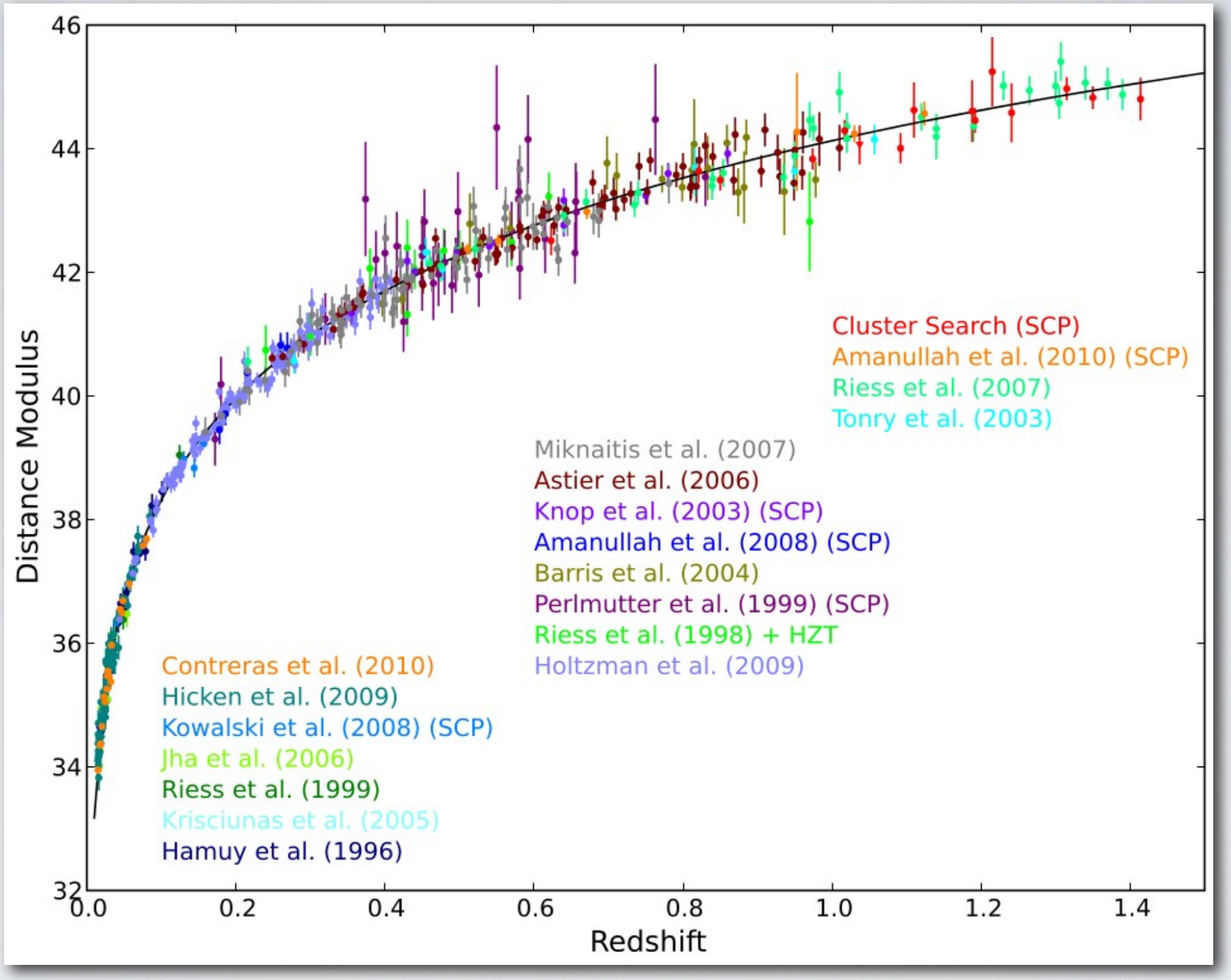
SN Ia COSMOLOGY



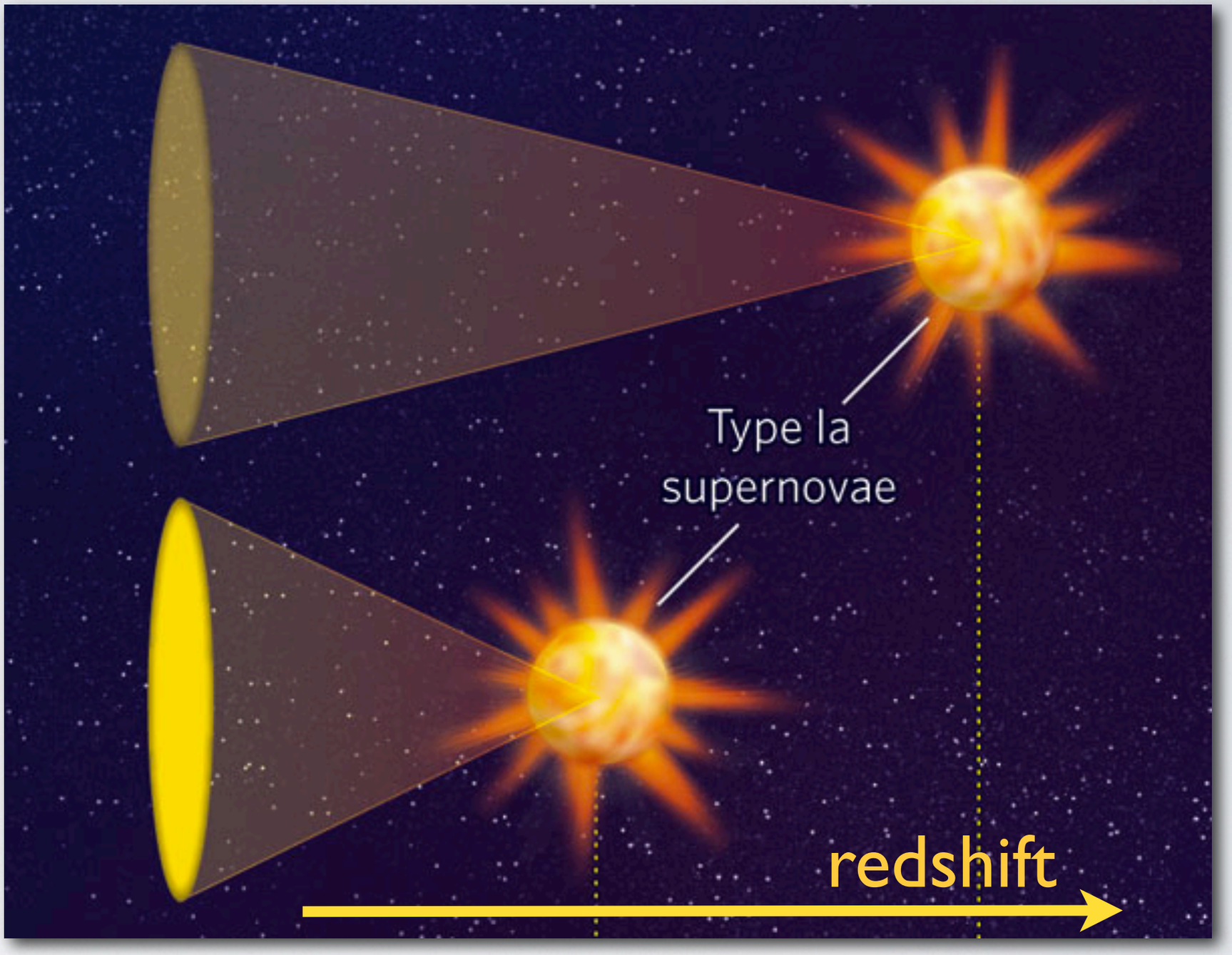
SN Ia COSMOLOGY

Key elements:

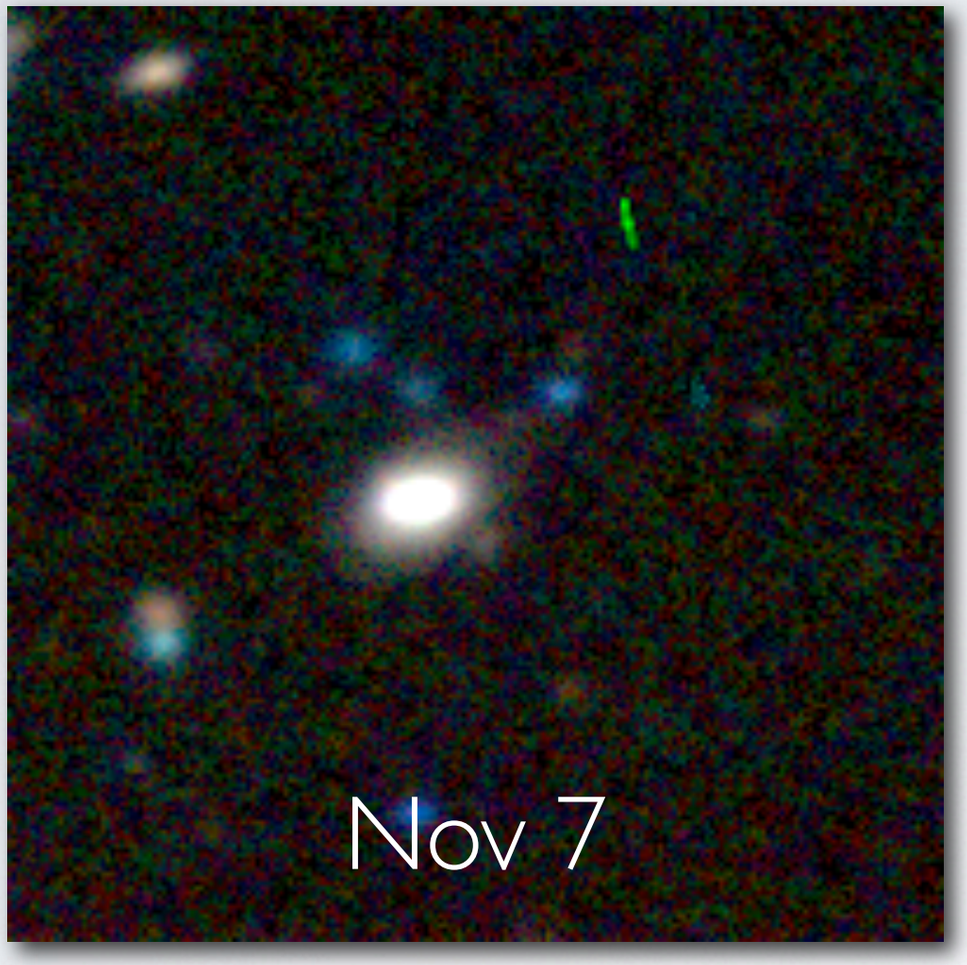
Typing
spectra
photometry

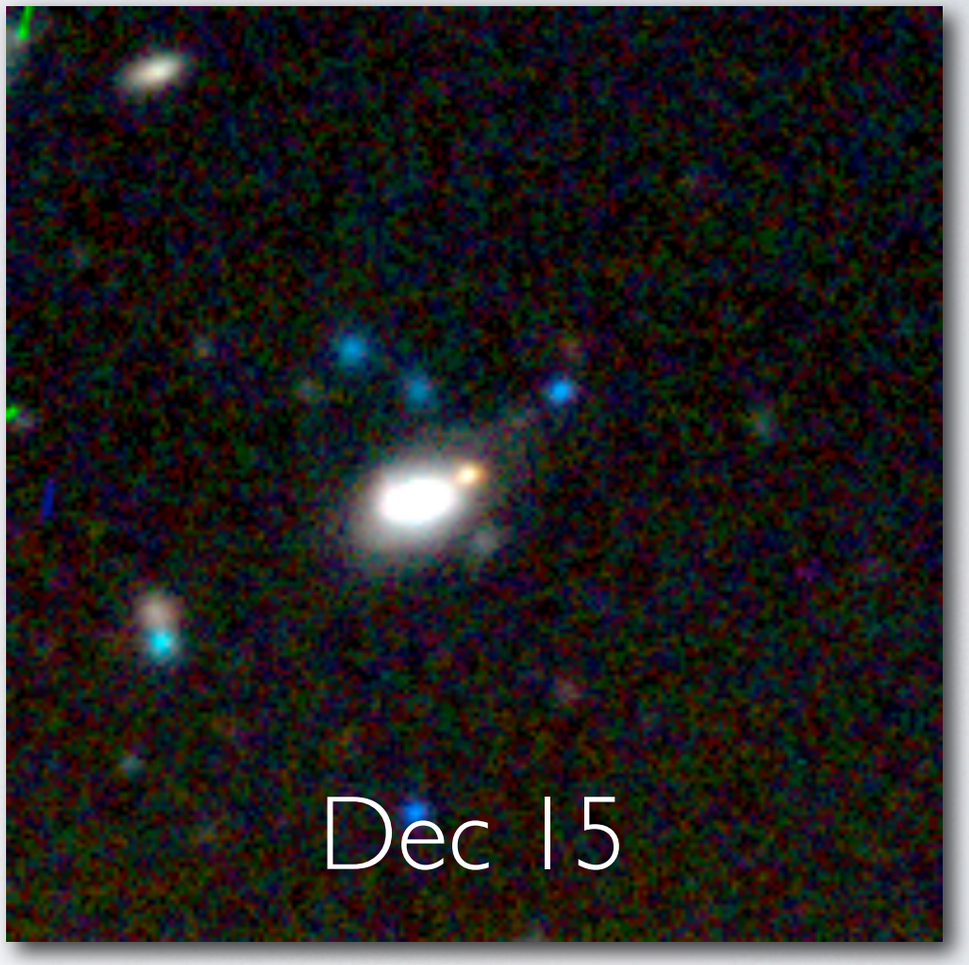
Redshift
spectra
photo-z

Calibration
photometry



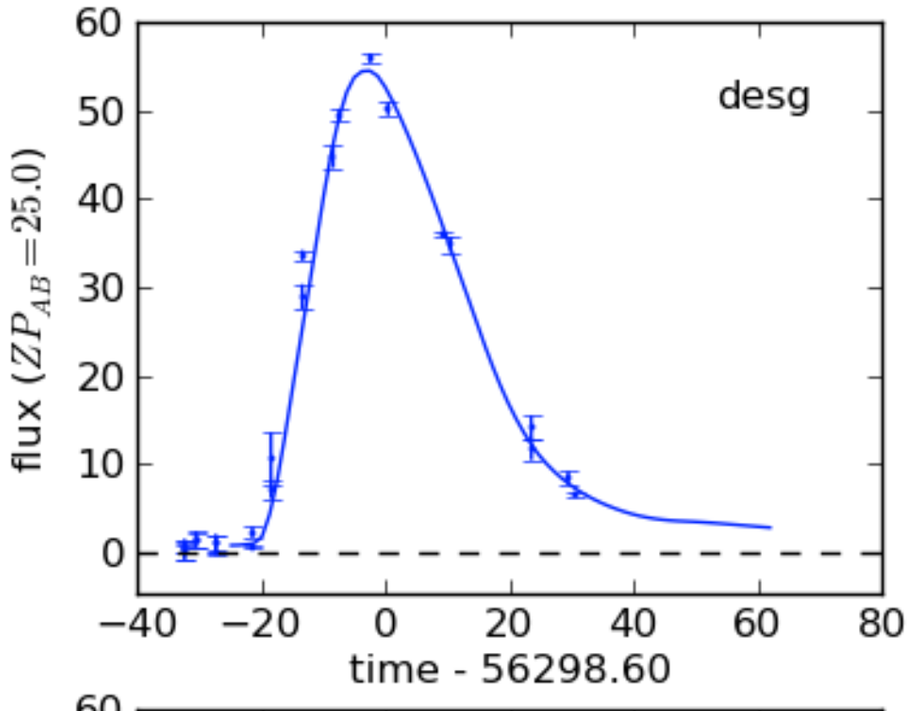
FIRST CONFIRMED DES SN

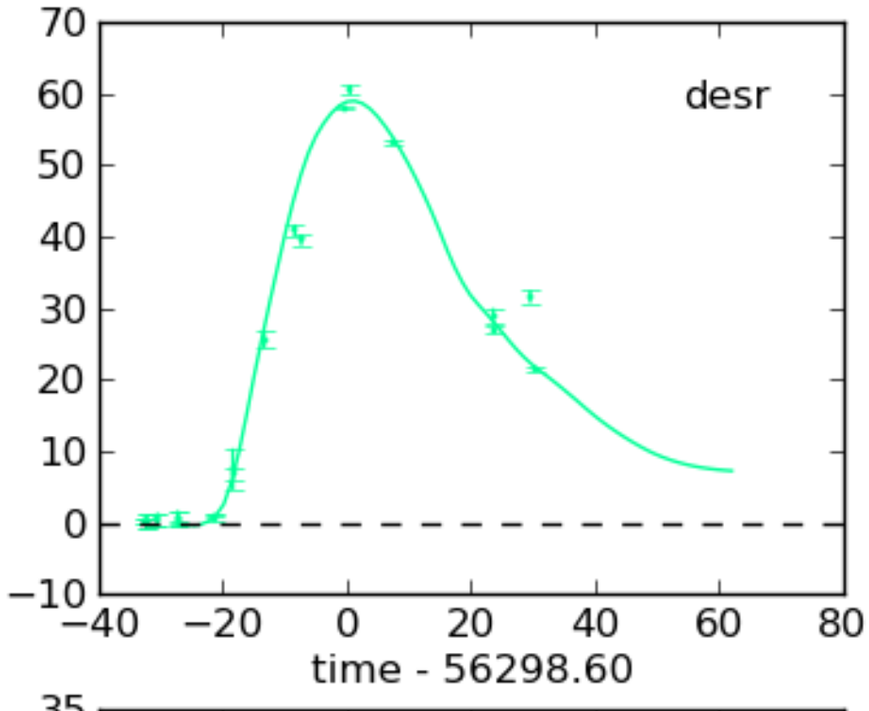


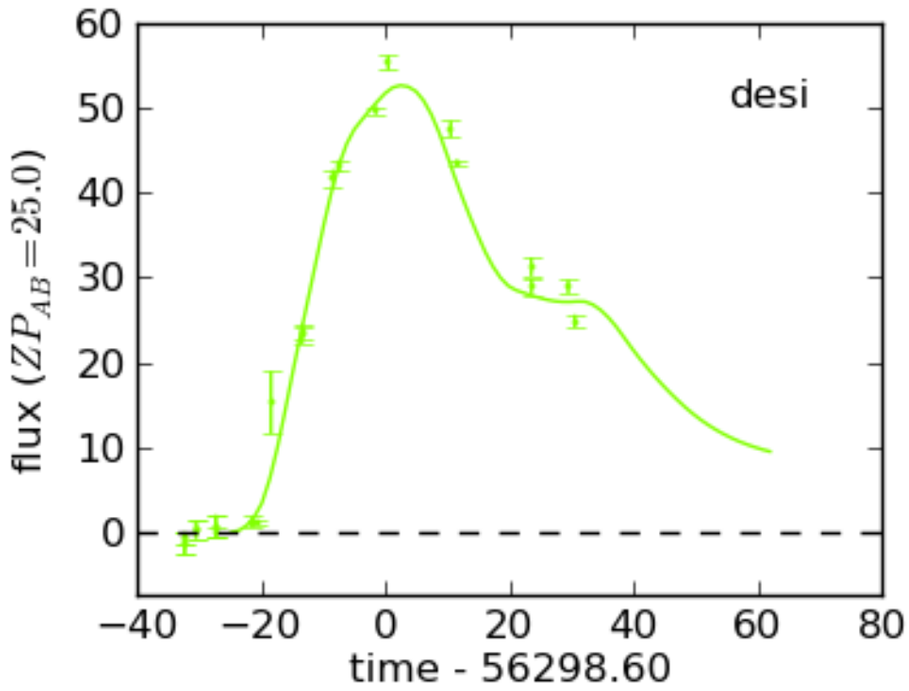


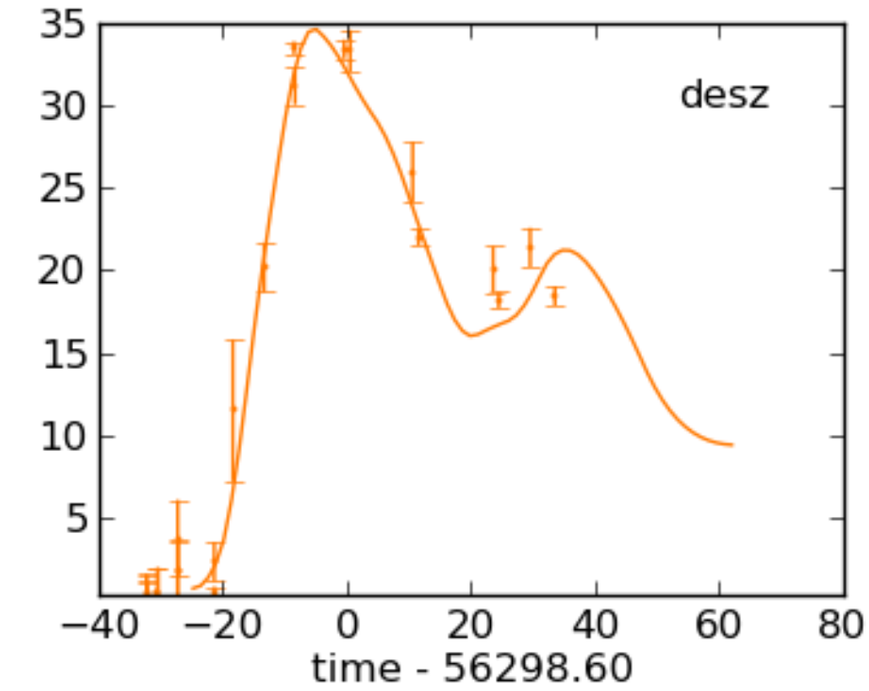
SN Ia at z=0.2 confirmed at AAO

FIRST CONFIRMED DES SN



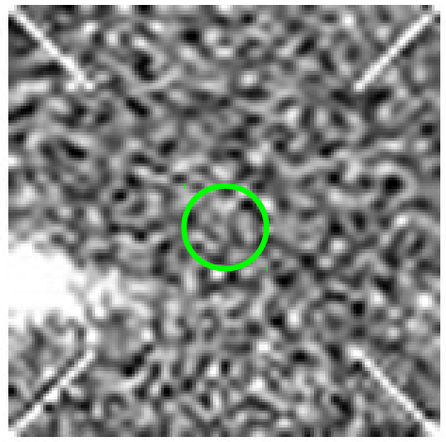






$z = 0.241$

DES12C3a
(642239)



SPECTROSCOPIC OBSERVATIONS

Spectroscopic observations of

the SNe

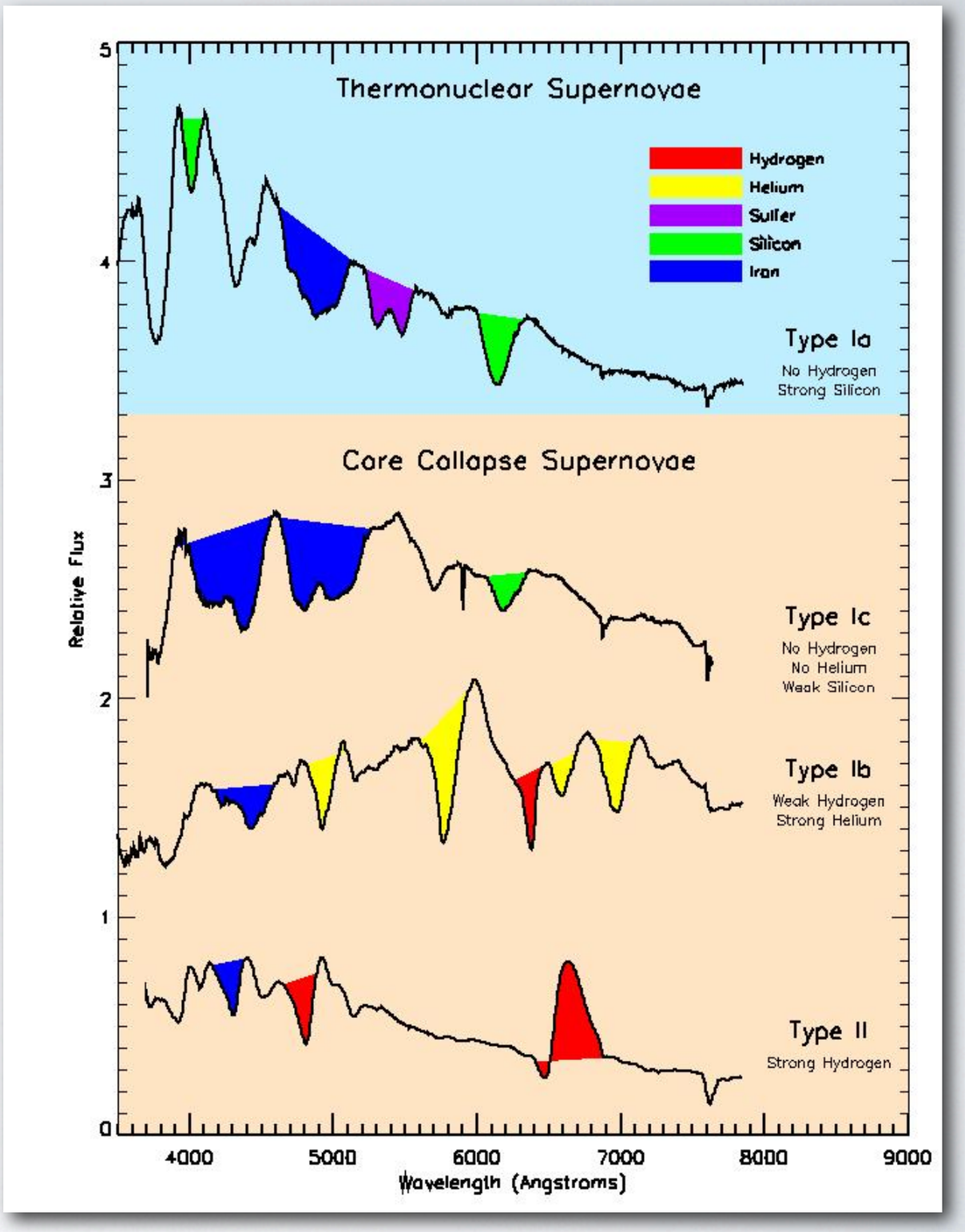
type, redshift

(tough because SNe fade in a matter of days)

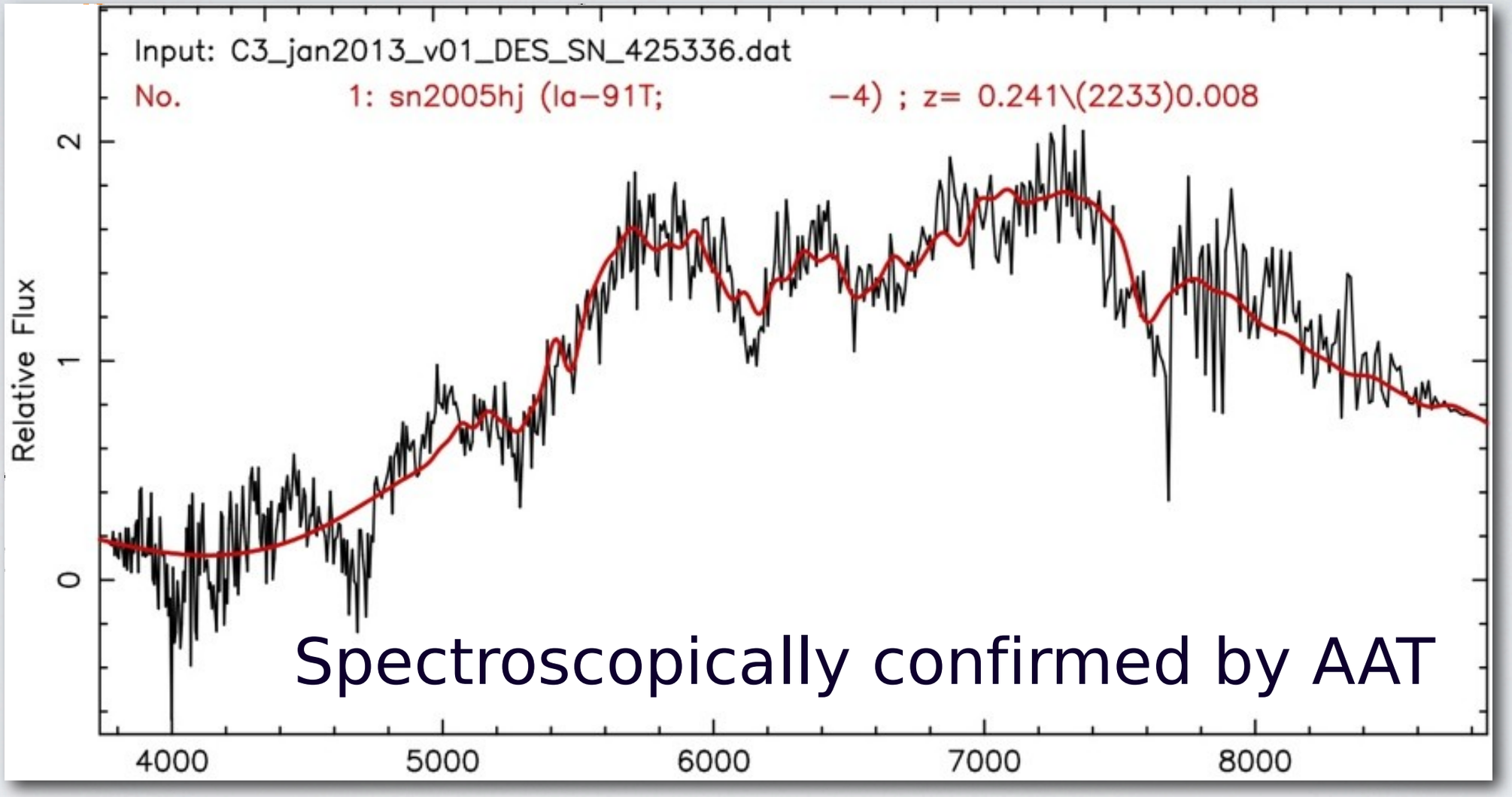
the host galaxy

redshift

(next best thing)



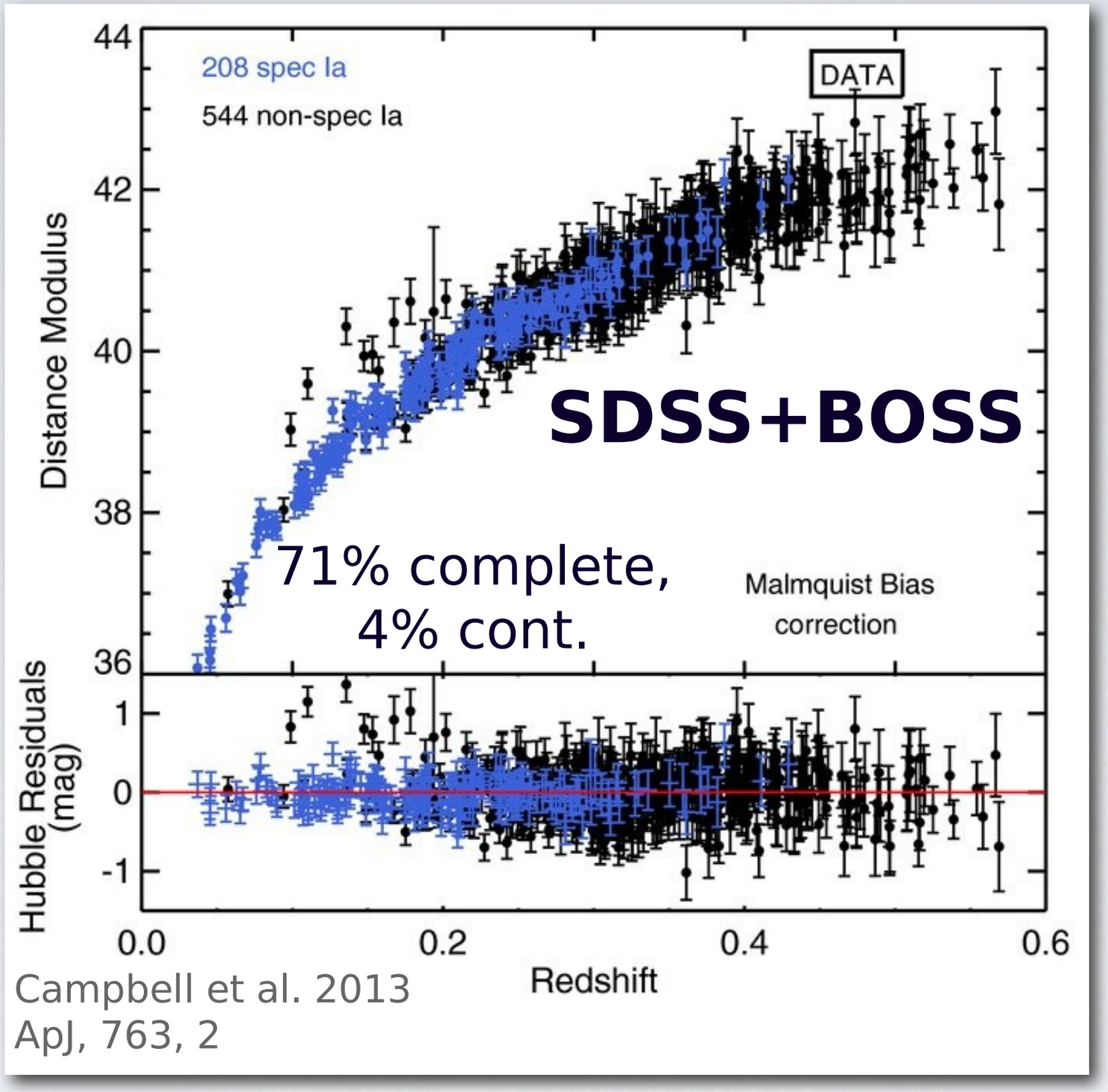
FIRST CONFIRMED DES SN



CURRENT SURVEYS

	Dark Energy Survey	Current Major Survey (SNLS: Megacam @ CFHT)
Number of Type Ia SNe	~3500 (Photometric typing)	~500 (spectroscopic typing)
Redshift range	up to z ~ 1.2 (deep z band)	up to z ~ 1.0
Fields	10 pointings @ 3 deg^2 (8 “shallow”, 2 “deep”)	4 pointings @ 1 deg^2 (all “deep”)
Cadence	~5 day cadence over 5 months	(similar)
Spectroscopic Follow-up	**Subset** of candidates observed by 4-10m class telescopes	**All** SN Ia candidates confirmed at 4-10m class telescopes

PHOTOMETRIC TYPING



Campbell et al. 2013
ApJ, 763, 2

ISN'T THIS IDEAL SCIENCE FOR MKIDS-BASED INSTRUMENTS?

- Although the SNe community has learned how to obtain typing from broadband photometric data...
  - SDSS (Cosmology results published in Campbell et al. 2013, arXiv: 1211.4408)
  - DES (Starting in 4 days; results of simulations in Bernstein et al. 2012, arXiv:1111.1969)
  - LSST (Planned for ~2020; white paper by Collaboration in arXiv:1211.0310)

- ... and the field is progressively moving away from increasingly difficult spectroscopic followups...
  - DES plans to followup most SNe hosts for redshift determination and a small fraction of SNe as control sample for photometric typing
  - Followup of most SNe hosts in LSST is very challenging for traditional spectrographs
  - There are currently no plans to build a large FOV multi-thousand fiber spectrograph in the Southern hemisphere

ISN'T THIS IDEAL SCIENCE FOR MKIDS-BASED INSTRUMENTS?

- ... there seems to be an opportunity here for MKIDs to add to the current CCD-based programs...
  - MKID cameras provide typing, redshift and photometry with one shot
  - We can take advantage of time resolution and 'no filters' feature to achieve superb calibration (signal-to-noise) within reasonable observing times
  - We are still a bit far from a wide FOV camera to make an MKID-only SNe survey, but we can envision a program where a small dedicated MKIDs camera does follow up for a large fraction of DES or LSST SNe
- ... and to do better (lower systematics)
  - Even at low resolutions (R~50) typing of SNe observed with MKIDs should be better than purely photometric
  - Calibration of MKIDs data could be much better than 1%
  - Spectrophotometric info for the host and the SNe are obtained at the same time
  - 4-band light curves replaced by light curves for each wavelength

SUMMARY

- MKIDs are (in principle) ideal instrument to provide spectrophotometric information for SNe surveys

- A program entirely based on MKIDs would require large FOV, better energy resolution and a better understanding of the detector than what seems achievable in the time scale of DES
  - But maybe we can do it for LSST?

- A followup program, in coordination with DES or LSST, seems a more realistic scenario
  - (A lot) more work is needed to determine how much improvement we actually get
  - We need to engage the SNe community to make this happen